United States Patent [19]

Edstrom

[11] **3,806,878**

[45] **Apr. 23, 1974**

[54] **CONCURRENT SUBSYSTEM DIAGNOSTICS AND I/O CONTROLLER**

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[73] Assignee: **International Business Machines Corporation,** Armonk, N.Y.

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[21] Appl. No.: **169,193**

[52] **U.S. Cl.** **340/172.5**
[51] **Int. Cl.** **G06f 9/00,** G06f 11/00
[58] **Field of Search** 340/172.5; 235/153

[56] **References Cited**

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Primary Examiner—Paul J. Henon
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Attorney, Agent, or Firm—Herbert F. Somermeyer

[57] **ABSTRACT**

Diagnostics in a peripheral subsystem for a data processing system are performed on a concurrent basis with other programs in the data processing system. The peripheral subsystem has capabilities of generating indications for the data processing system representative of operational conditions that could be encountered; the data processing system is programmed to respond to said indications for diagnosing the operational capabilities of the connected peripheral subsystem. Included in the diagnostics are interface checking between the subsystem and the rest of the data processing system, device status, capability of stacking status, capability of handling nonstackable status, verifying enable/disable operation, and checking device busy status and the like.

1 Claim, 6 Drawing Figures

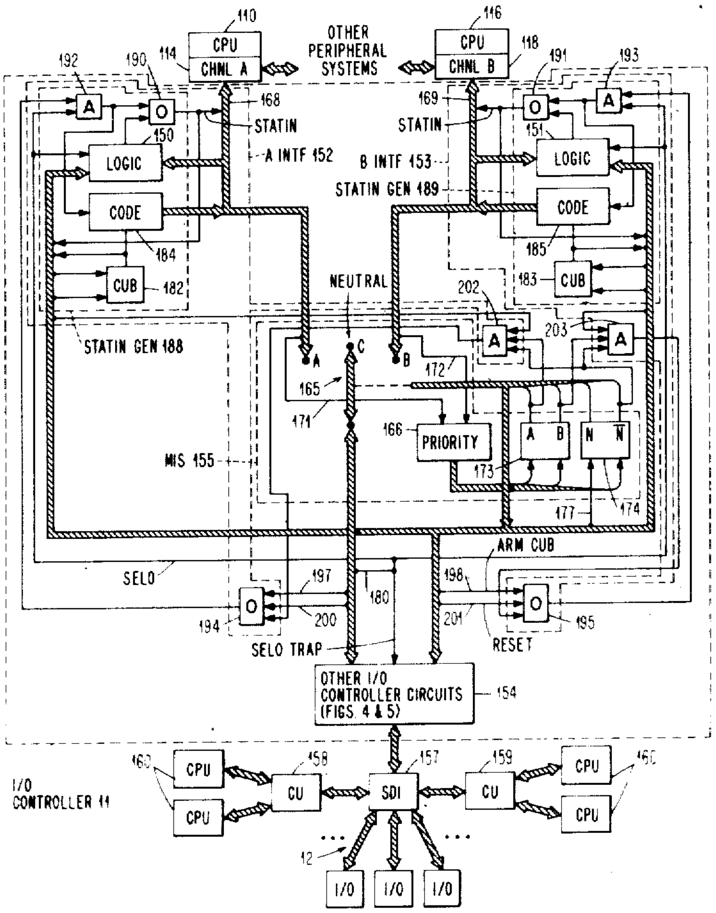


FIG. 1

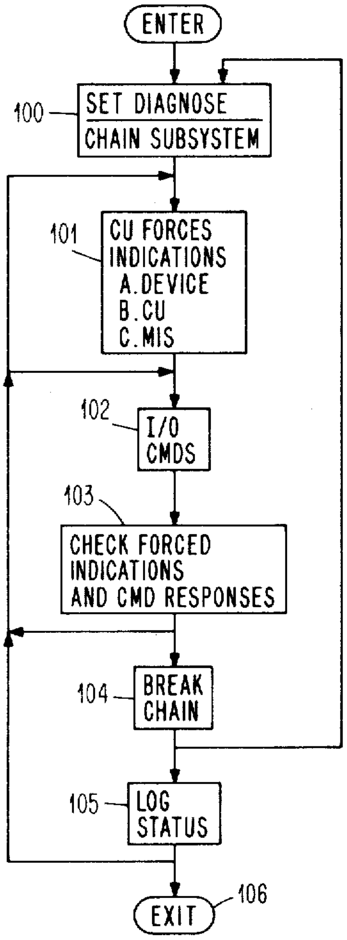

ENTER
100
SET DIAGNOSE
CHAIN SUBSYSTEM
101
CU FORCES
INDICATIONS
A. DEVICE
B. CU
C. MIS
102
I/O
CMDS
103
CHECK FORCED
INDICATIONS
AND CMD RESPONSES
104
BREAK
CHAIN
105
LOG
STATUS
EXIT
106

FIG. 2

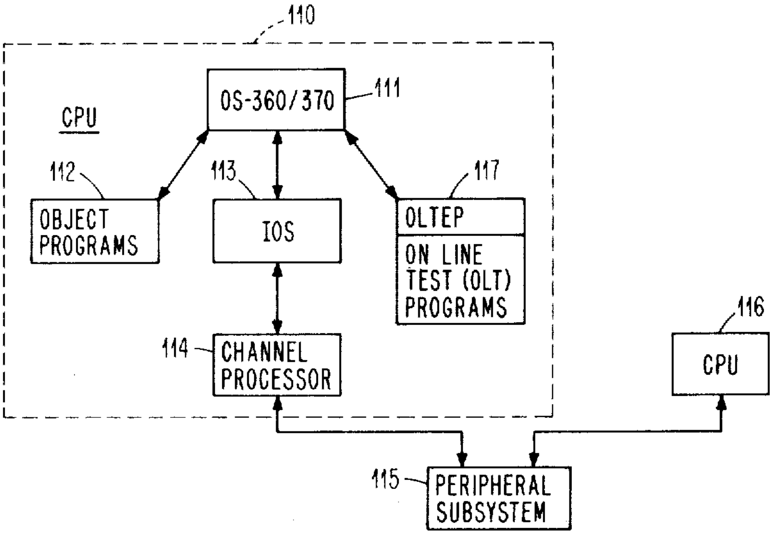

110
CPU
OS-360/370
111
112
OBJECT
PROGRAMS
113
IOS
117
OLTEP
ON LINE
TEST (OLT)
PROGRAMS
114
CHANNEL
PROCESSOR
116
CPU
115
PERIPHERAL
SUBSYSTEM

FIG. 3

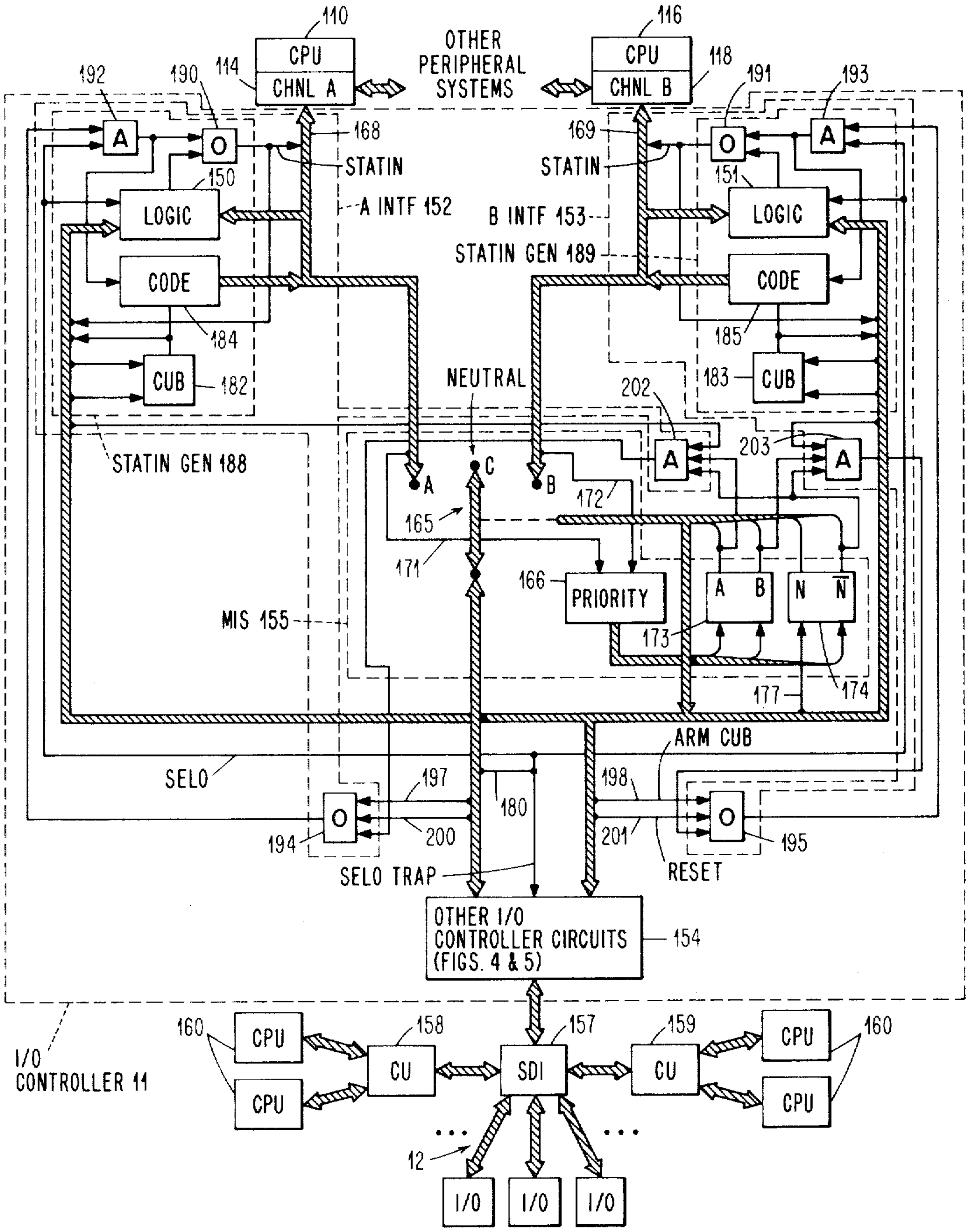

110
CPU
CHNL A
114
OTHER PERIPHERAL SYSTEMS
116
CPU
CHNL B
118
192
A
190
O
168
STATIN
150
LOGIC
A INTF 152
CODE
184
CUB
182
STATIN GEN 188
191
193
169
STATIN
151
LOGIC
B INTF 153
STATIN GEN 189
CODE
185
183
CUB
NEUTRAL
A
C
B
202
203
172
165
171
166
PRIORITY
173
A B
N N̄
174
177
MIS 155
ARM CUB
SELO
197
180
198
194
O
200
201
O
195
SELO TRAP
RESET
OTHER I/O CONTROLLER CIRCUITS (FIGS. 4 & 5)
154
I/O CONTROLLER 11
160
CPU
CPU
158
CU
157
SDI
159
CU
CPU
CPU
160
12
I/O
I/O
I/O

FIG. 4

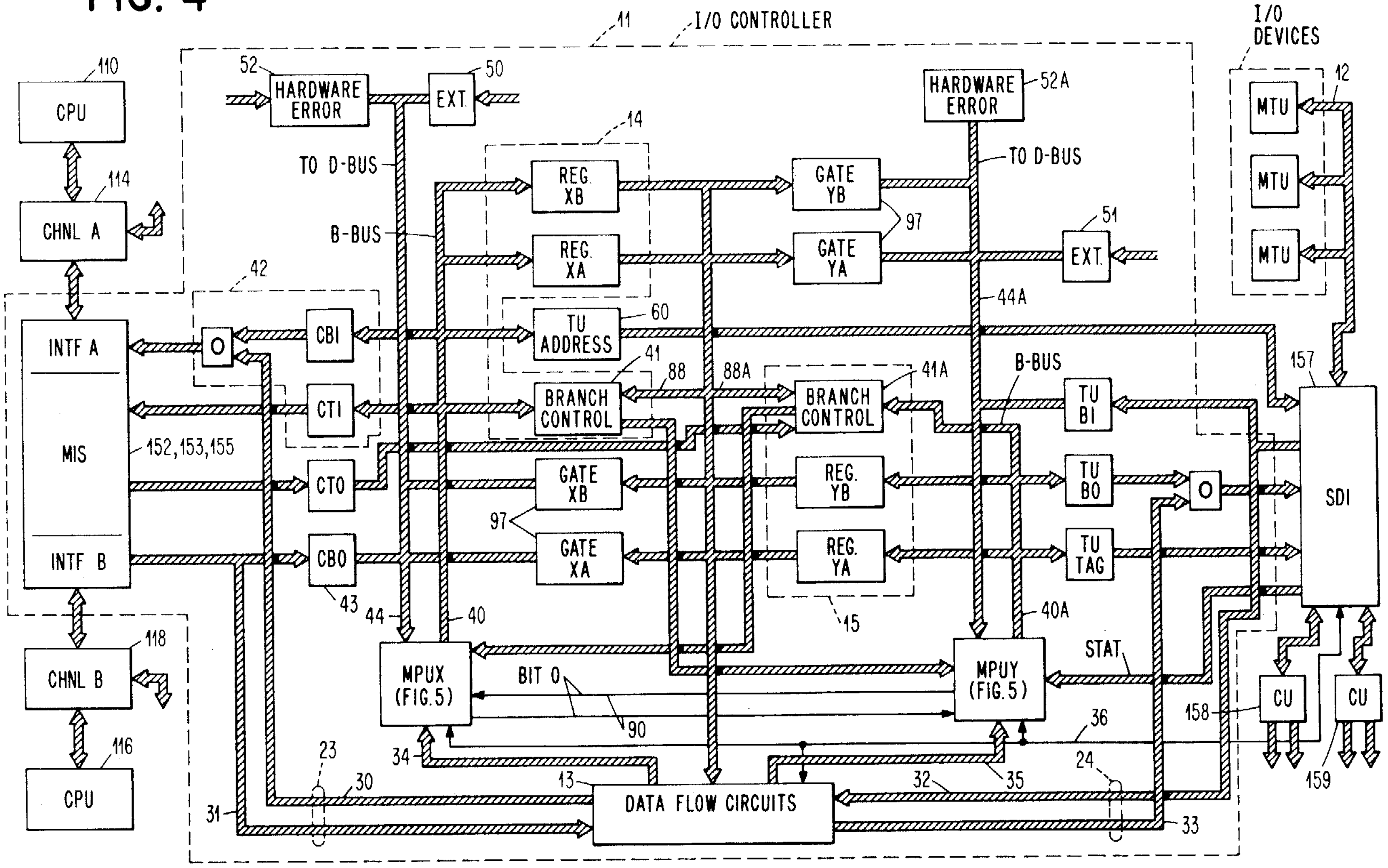

11
I/O CONTROLLER
I/O DEVICES
12
MTU
MTU
MTU
110
CPU
114
CHNL A
52
HARDWARE ERROR
EXT.
50
TO D-BUS
B-BUS
14
REG. XB
REG. XA
TU ADDRESS
60
41
BRANCH CONTROL
88
88A
41A
BRANCH CONTROL
GATE YB
GATE YA
97
EXT.
51
HARDWARE ERROR
52A
TO D-BUS
44A
B-BUS
TU BI
TU BO
TU TAG
O
157
SDI
42
O
CBI
CTI
CTO
CBO
43
INTF A
MIS
INTF B
152,153,155
GATE XB
GATE XA
97
REG. YB
REG. YA
15
44
40
40A
MPUX (FIG.5)
BIT 0
90
MPUY (FIG.5)
STAT
36
158
CU
CU
159
118
CHNL B
116
CPU
23
30
31
34
13
DATA FLOW CIRCUITS
32
35
24
33

FIG. 5

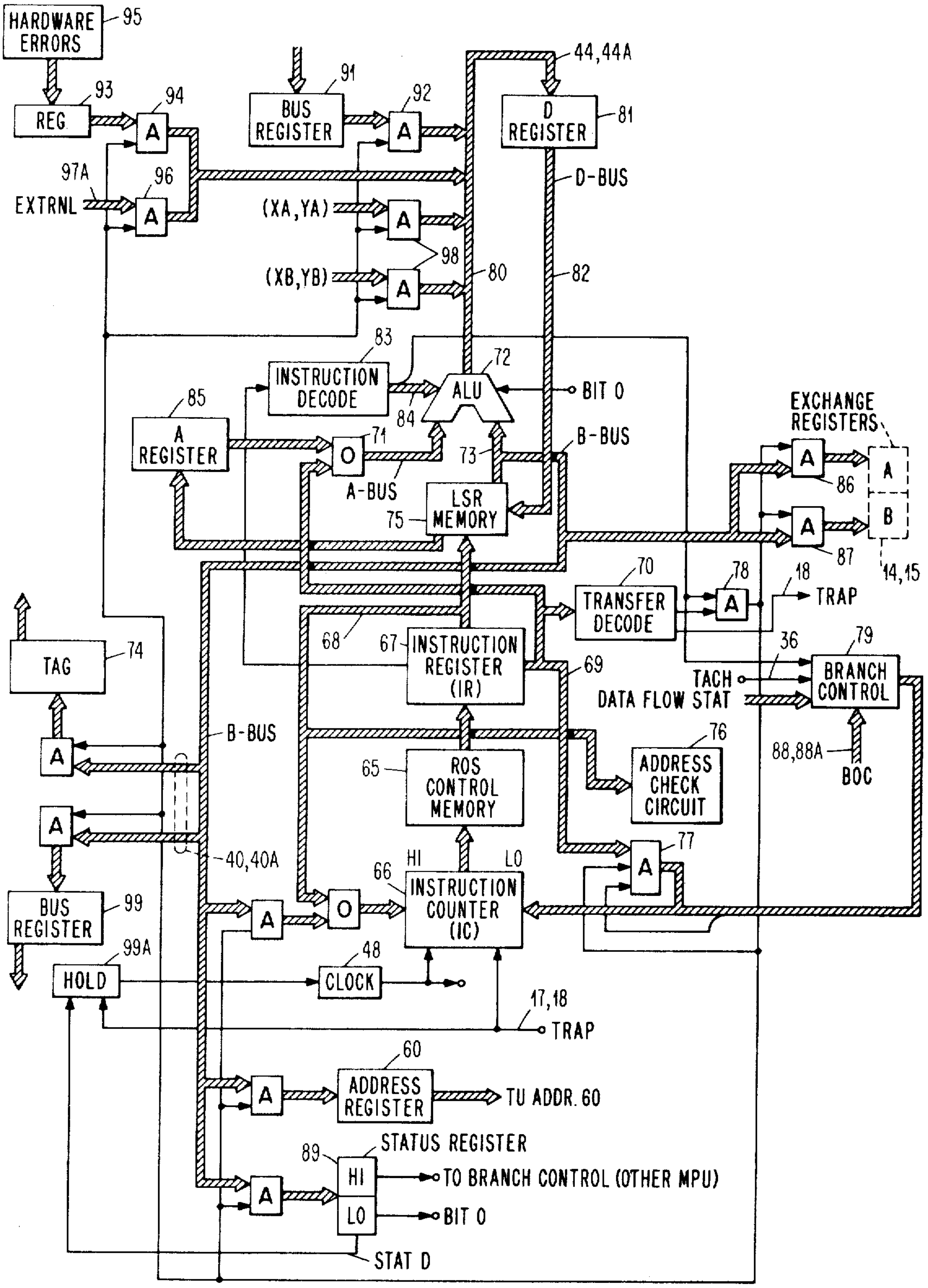
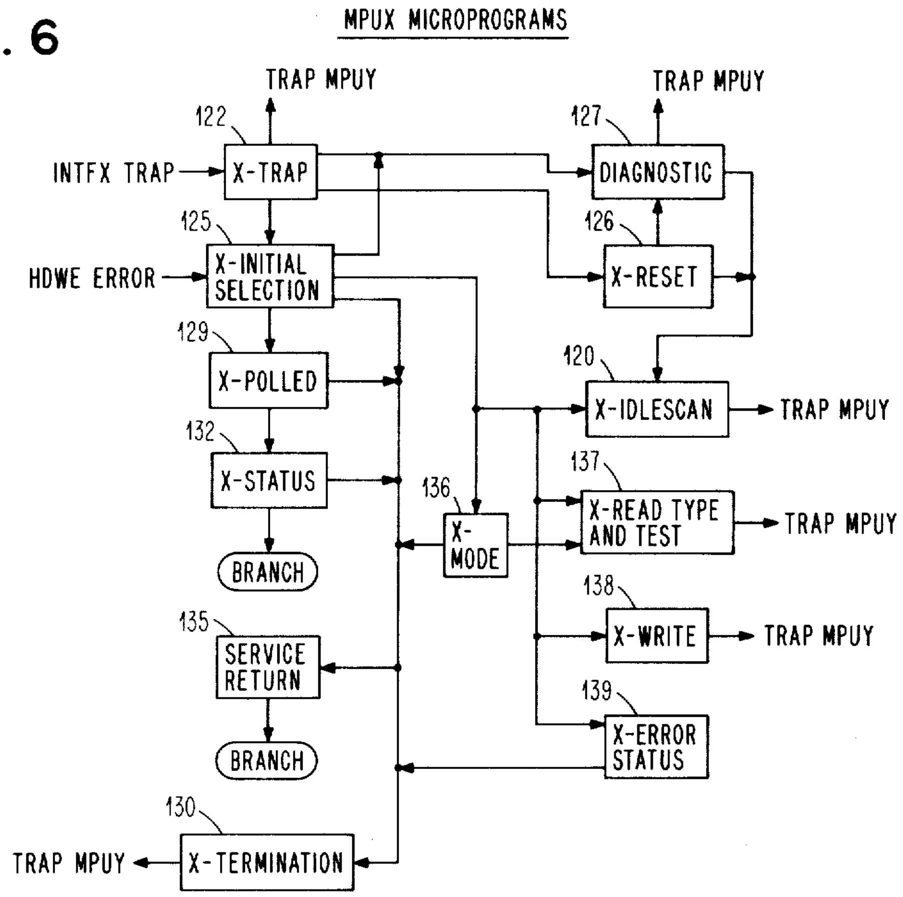
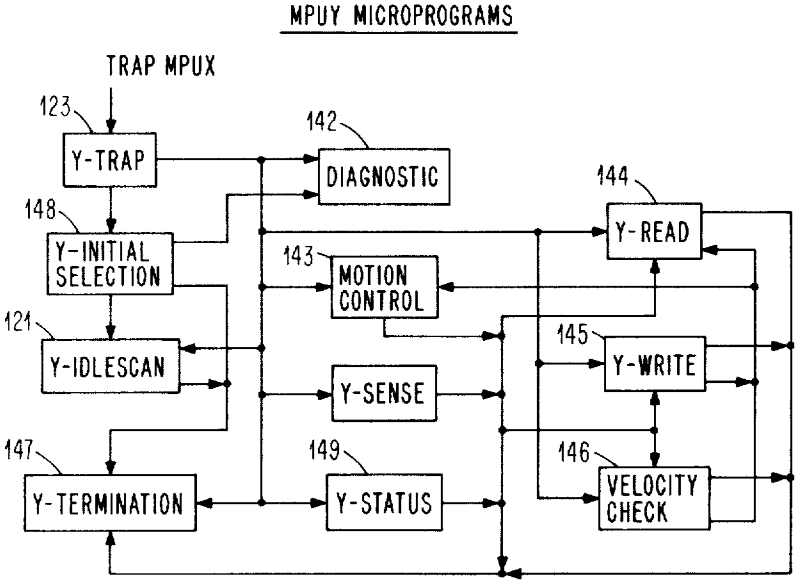

HARDWARE ERRORS
95
REG
93
A
94
97A
EXTRNL
A
96
91
BUS REGISTER
92
A
44,44A
D REGISTER
81
D-BUS
(XA,YA)
A
98
(XB,YB)
A
80
82
83
INSTRUCTION DECODE
84
ALU
72
BIT 0
85
A REGISTER
O
71
A-BUS
73
B-BUS
LSR MEMORY
75
EXCHANGE REGISTERS
A
86
A
87
A
B
14,15
70
TRANSFER DECODE
78
A
18
TRAP
68
67
INSTRUCTION REGISTER (IR)
69
36
79
TACH
DATA FLOW STAT
BRANCH CONTROL
88,88A
BOC
TAG
74
B-BUS
A
A
40,40A
65
ROS CONTROL MEMORY
76
ADDRESS CHECK CIRCUIT
77
A
HI
LO
66
INSTRUCTION COUNTER (IC)
BUS REGISTER
99
99A
HOLD
A
O
48
CLOCK
17,18
TRAP
60
A
ADDRESS REGISTER
TU ADDR. 60
STATUS REGISTER
89
A
HI
LO
TO BRANCH CONTROL (OTHER MPU)
BIT 0
STAT D

FIG. 6


MPUX MICROPROGRAMS
TRAP MPUY
TRAP MPUY
122
127
INTFX TRAP
X-TRAP
DIAGNOSTIC
125
126
HDWE ERROR
X-INITIAL SELECTION
X-RESET
129
120
X-POLLED
X-IDLESCAN
TRAP MPUY
132
137
X-STATUS
136
X-READ TYPE AND TEST
TRAP MPUY
X-MODE
BRANCH
138
135
X-WRITE
TRAP MPUY
SERVICE RETURN
139
X-ERROR STATUS
BRANCH
130
TRAP MPUY
X-TERMINATION


MPUY MICROPROGRAMS
TRAP MPUX
123
142
Y-TRAP
DIAGNOSTIC
144
148
Y-READ
Y-INITIAL SELECTION
143
MOTION CONTROL
121
145
Y-IDLESCAN
Y-WRITE
Y-SENSE
147
149
146
Y-TERMINATION
Y-STATUS
VELOCITY CHECK

CONCURRENT SUBSYSTEM DIAGNOSTICS AND I/O CONTROLLER

DOCUMENTS INCORPORATED BY REFERENCE

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2. "IBM System/360 Engineering," by P. Fagg et al, PROCEEDINGS-FALL JOINT COMPUTER CONFERENCE, 1964, Pages 205–231.

3. U.S. Pat. No. 3,214,739 (a two-channel switch or multiple interface switch).

4. U.S. Pat. No. 3,303,476 (channel).

5. U.S. Pat. No. 3,336,582 (CPU channel commands to control unit).

6. U.S. Pat. No. 3,372,378 (a switching system for a data processing system).

7. U.S. Pat. No. 3,400,371 (a CPU).

8. U.S. Pat. No. 3,550,133 (a channel).

9. U.S. Pat. No. 3,377,619 (polling in a channel including select out).

10. Commonly assigned patent application Cormier et al., Ser. No. 101,079, filed Dec. 22, 1970, entitled "Command Retry Control by Peripheral Devices," now U.S. Pat. No. 3,688,274.

BACKGROUND OF THE INVENTION

The present invention relates to data processing systems having peripheral device subsystems and particularly to concurrent diagnostics as between a data processing system and the peripheral subsystem, for concurrently diagnosing the present operational capability of the peripheral subsystem.

Because of equipment complexities and high performance operating capabilities, data processing systems, and particularly peripheral device subsystems, are periodically analyzed for proper operational status and capabilities. Also, when an error is introduced into the data processing system, apparently by a peripheral device subsystem, certain diagnostic procedures should be invoked for diagnosing the cause of the error so that corrective maintenance can be expedited. In most prior systems, diagnostics relating to a peripheral device subsystem, such as a printer system, magnetic tape subsystem, disk system, drum system, communication system, and the like, either require dedication of a central processing unit (CPU) for diagnosing the present operational capabilities of the peripheral device subsystem (control mode) or that the peripheral device subsystem be completely disconnected from the data processing system and be operated in a diagnostic mode by maintenance personnel (off-line mode). The above procedures, while effective to perform the diagnostics and the maintenance, are quite expensive because: (1) the cost per hour of a data processing system is extremely high; therefore, to assign the entire data processing system for maintaining one peripheral device subsystem is a very expensive procedure. (2) Disconnecting a peripheral device subsystem from a data processing system in many instances may require the data processing system to be stopped while the peripheral device subsystem is disconnected. This means additional start-ups and, again, a waste of data processing system total time which becomes expensive. Further, no portion of the peripheral device subsystem is then available for any usage by the data processing system. Maintenance personnel must slowly diagnose the operational status of the peripheral device subsystem without the assistance of automated analysis generally available through a CPU. While some automatic test equipment may be employed, the analysis performable by a CPU usually is much greater than that which can be performed by test equipment. Again, once the subsystem has been diagnosed, it must be reconnected to the data processing system. (3) While disconnecting a peripheral device subsystem from a data processing system may be effective to diagnose operational status of the peripheral device subsystem, some errors can occur in the interface portion. Such disconnection may or may not detect such error-causing conditions. Accordingly, it is highly desirable that concurrent diagnostics be performed on a peripheral device subsystem by a data processing system.

As used in this application, the term "concurrent mode" indicates that the data processing system has other tasks or jobs in the system that are active and share system facilities with the diagnostic programs and procedures. This does not necessarily indicate that a given CPU will operate simultaneously on a data processing job or task and a diagnostic job or task. Such jobs or tasks may be interleaved within the CPU with the peripheral device subsystem diagnostics being performed simultaneously with data processing systems or other operations being performed by other subsystems or CPU's.

"Quiescent mode" means that all operations with respect to a peripheral device subsystem are complete except those initiated directly or indirectly by an OLT (on-line test) such that the peripheral device subsystem is dedicated to diagnostics initiated by the OLT. The CPU may be still operating in a concurrent mode.

On-Line Test (OLT) — A computer program in a CPU designed to initiate diagnostic procedures in a peripheral device subsystem upon command from an operating system within the CPU. Such OLT's supervise diagnostic procedures.

On-Line Test Executive Program (OLTEP) — The interfacing program between the CPU operating system and OLT's. It is a supervisory program effecting proper sequencing of diagnostics effected by OLT's.

Control Mode — A peripheral device subsystem is entirely dedicated to diagnostics. The OLT responds to all communications with the peripheral device subsystems and operates to the peripheral device subsystem via OLTEP and can act in the supervisory mode. OLT restricts its activities to those devices in the peripheral device subsystem assigned to it by and through OLTEP before entry into the control mode. Entry of control mode usually requires a console entry and an OLT request. Exit from either the quiescent or control mode is by initiation from a request via the console into OLTEP.

Accordingly, for concurrent diagnostic purposes, computer programs have been established including an on-line test executive program (OLTEP) for initiating and supervising concurrent diagnostic procedures. Some of the test requirements to date have required the device being diagnosed to be off-line for effecting a full test of the operating capabilities. Partial tests have been operated on a concurrent mode for a limited number of device operating characteristics. Limited testing on a concurrent basis does not provide sufficient meaningful diagnostic information for minimizing down time of a data processing system. Accordingly, it is very desirable and important that concurrent diagnostic capabilities be enhanced.

SUMMARY OF THE INVENTION

It is an object of this invention to provide enhanced concurrent diagnostic procedures for interface checking, status reporting, enable/disable, tag signals, and the like.

A peripheral device subsystem utilizing the teachings of the present invention includes means for performing signal processing or data processing operations in connection with a data processing system. Additionally, means are provided for generating operating condition indications responsive to channel commands to esablish conditions within the subsystem representative of operating conditions not permissible during normal signal processing operations. The above usually follows a SET DIAGNOSE channel command which initiates a diagnostic mode within the peripheral subsystem. Preferably, chaining to an OLT operated CPU is required. During such diagnostic mode, a series of channel commands are issued by the CPU to the peripheral device subsystem forcing stacking status, forcing a falsely indicated control unit busy (CUB) or device busy (DVE BSY), and initiating enable/disable operations and checking response of the peripheral subsystem to nonstackable status as well as to device and I/O controller stackable status. Dedication of the interface between a data processing system and a peripheral device subsystem is performed on a concurrent basis for diagnosing responses and actuations of the peripheral device subsystem with respect to such interface.

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

THE DRAWINGS

FIG. **1** is a simplified flowchart showing a sequence of concurrent testing usable in connection with the present invention.

FIG. **2** is a simplified operating system diagram illustrating the broad aspects of the present invention.

FIG. **3** is a simplified block diagram of a system incorporating the teachings of the present invention.

FIG. **4** is a simplified logic block diagram of an I/O controller usable with the FIG. **3** illustrated system.

FIG. **5** is a simplified logic block diagram of a microprocessing unit (MPU) usable with the I/O controller illustrated in FIG. **4.**

FIG. **6** is a simplified block diagram of microprograms resident in the FIG. **5** illustrated microprocessor used to operate the FIG. **3** illustrated peripheral device subsystem.

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

This glossary provides a ready reference to the abbreviations repeatedly used in describing the invention:

ADDR	Address
ADDRI	Address In (a tag signal supplied by an I/O controller indicating address signals appear on CBI)
ADDRO	Address Out (a tag signal indicating address signals are being sent in bus out lines)
ALU	Arithmetic-Logic Unit
BKWD	Backward
BLK INT	Block Interrupt (I/O controller flag blocking SUPPRI)
BLK UC	Block Unit Check (I/O controller flag blocking UC status after a burst operation)
BOC	Branch on Condition
BOR	Beginning of Record (remains active during entirety of record readback signal envelope)
BOT	Beginning of Tape
CBI	Channel Bus In (lines for carrying data signals from I/O controller to CPU via INTFX)
CBO	Channel Bus Out (lines for carrying data signals from a channel to an I/O controller)
CCW	Channel Control Word
CHNL	Channel
CMD	Command (a set of control signals)
CMDO	Command Out (a tag signal telling an I/O controller to change operation in accordance with predetermined criteria)
CPU	Central Processing Unit
CTI	Channel Tag In (a set of lines for tag signals supplied from an I/O controller to a data channel concerning the interpretation of other signals supplied over CBI)
CTO	Channel Tag Out (a set of lines for tag signals supplied from a data channel to an I/O controller interpreting other signals supplied over CBO)
CU	Control Unit; an I/O Controller
CUB	Control Unit Busy (a tag signal)
DE	Device End (a tag signal from an I/O device indicating end of an operation)
DEP	Device End Prime (see below)
DEPRIME	Device End Prime (a flag signal in a memory unit indicating a data channel has previously requested access to an I/O device. Upon receipt of a device end (DE), signals are supplied to the channel to provide access to the I/O device)
DIAG	Diagnostic
DIAGNOSE	A command ordering an I/O controller to enter a diagnostic mode of operation.
FWD	Forward
GENRST	General Reset
IBG	Interblock Gap
IC	Instruction Counter
IDLEPEND	A wait routine for the channel microprogram unit used to wait for further instructions from a data channel
IDLESCAN	A microprogram used to scan for DEPRIMES
IHS	Information Handling System
INTF	Interface Circuits
I/O	Input/Output or Input/Output Device
IOS	I/O System (a CPU program operating under OS and added to control I/O operations)
IR	Instruction Register
LSR	Local Store Register
MIS	Multiple Interface Switch
MPU	Microprogrammable Unit
MPUX	Microprogrammable Unit No. X (used in connection with a data channel)
MPUY	Microprogrammable Unit No. Y (used in connection with an I/O device)
MTU	Magnetic Tape Unit
NOP	No Operation (do-nothing command)
OLT	On-Line Test (a CPU program for exercising and testing a peripheral device connected to the CPU)
OLTEP	On-Line Test Executive Program (a controlling program for OLT's)

OP	Operation
OPIN	Operation In (a tag signal)
OS	Operating System (a CPU control program)
RES	Reserved
ROS	Read Only Store
RST	Reset
RTN	Return
SDI	Subsystem Device Interface (a multiplexing switch selectively connecting several CU's to a plurality of I/O devices)
SELO	Select Out (a tag signal from channel to CU attempting a selection (connection))
SELRST	Selective Reset
SFBKWD	Space File Backward
SFFWD	Space File Forward
SIO	Start I/O (a command initiating an I/O OP)
SPACE OP	An MTU Space Operation (moves or spaces tape)
STAT	Status
STATIN	Status In (a tag signal indicating CBI has a status byte)
STIN	Status In (see STATIN)
STS	Status
SUPPRI	Suppressible Request In (a tag signal)
SUPPRO	Suppress Out (a tag signal)
SVCI	Service In (a tag signal)
SVCO	Service Out (a tag signal)
TACH	Tachometer
TAPE OP	Tape Operation
TCB	Task Control Buffer
TIO	Test I/O
TM	Tape Mark
TU	Tape Unit, also MTU
TUADDR	Tape Unit Address Register
TUBI	Tape Unit Bus In
TUBO	Tape Unit Bus Out
TUTAG	Tape Unit Tag Register
XA	Exchange Register XA
XB	Exchange Register XB
YA	Exchange Register YA
YB	Exchange Register YB

GENERAL PROCEDURE

Referring now to FIG. **1**, the general procedure followed by a data processing system and a peripheral device subsystem for effecting concurrent diagnostics using the present invention is explained. First, a CPU at **100** supplies a SET DIAGNOSE channel command to the peripheral device subsystem for initiating diagnostic mode in the connected subsystem. It then forces the subsystem to be chained to the DIAGNOSE command such that no other data processing system can interrupt the diagnostic procedures and thereby introduce errors inadvertently into the interrupting data processing system. The SET DIAGNOSE command is initiated by an OLT via OLTEP to a channel processor. The subsystem is responsive to the command and its CCW to establish a diagnostic mode in accordance with the CCW as has been well known. Upon completion of step **100**, the peripheral device subsystem is ready to perform concurrent diagnostics.

CPU then sends diagnostic commands to the peripheral subsystem at **101**. This includes forced indications in the I/O controller with regard to I/O devices, the control unit (CU), and to an MIS (multiple interface switch). Other indications, as well, may be forced for indicating operating status for diagnostic purposes, as will become apparent. At the end of step **101**, the peripheral device subsystem has been set for diagnosing responsiveness to selected input/output commands and operational status with respect to certain selected channel commands.

The CPU then supplies one or more chained I/O commands at **102**. At **103**, after the connected peripheral device subsystem has responded to the I/O commands supplied at **102**, the CPU checks the forced indications and command responses for diagnostic purposes. In accordance with the OLT, steps **102** and **103** may be repeated. Alternatively, step **101** may be reinitiated for performing a second concurrent diagnostic procedure. Chaining may be maintained as steps **101**, **102**, and **103** and repeated for different operating diagnostics. It may be desirable for fully utilizing the concurrency of the diagnostic procedures to break the chaining at **104** for permitting interleaved data processing operations. That is, the concurrent diagnostics may be performed in connection with one or two peripheral devices. The other devices are available for data processing operations, and it may be desirable to interleave the diagnostics with the data processing operations at the subsystem level in order to reduce diagnostic cost to the data processing system. Accordingly, when the chain is broken at **104**, other programs within the operating system or other data processing systems connected to the peripheral device subsystem can initiate data processing operations. After the chain is broken at **104**, step **100** may be repeated for a subsequent diagnostic, with the steps **100**, **101**, **102**, and **103** also repeated. Finally, after the concurrent diagnostics, as requested by an initial program load (IPL) operating through OLTEP, the status is logged in CPU at **105** and probably printed out for use by maintenance personnel assigned to the data processing subsystem. The programming exits at **106** completing the diagnostic task.

SYSTEM ORGANIZATION

Referring to FIG. **2**, the environment in which the present invention may be practiced is shown in simplified form. CPU **110** has an operating system such as OS/360 or OS/370 at **111**. OS is an executive which calls in object programs **112** for performing data processing operations, as is well known. The input/output program module **113** (IOS) program connects a channel processor **114** to OS **111** for effecting input/output operations. Channel processor **114**, in turn, communicates with one or more peripheral subsystems **115** which performs the actual I/O operations. The peripheral subsystem additionally, through MIS, is connectable to another CPU **116** which is organized in the same manner as CPU **110**. Additionally, CPU **110** has a set of diagnostic programs **117** which includes OLTEP and a set of OLT's. The OLT's may be resident on a disk subsystem (not shown) and callable into magnetic core memory of CPU **110** upon initiation by an IPL. Once an OLT is resident in CPU **110**, it calls in operation of peripheral subsystem **115** through the programmed and hardware chains just described. The OLT controls CPU **110** just long enough to initiate operations of peripheral subsystem **115** during a diagnostic mode. During such diagnostic mode, channel processor **114** may be dedicated to the diagnostic procedure. Additionally, CPU **110** may have a plurality of such channel processors. In the alternative, channel processor **114** may service several I/O subsystems with each subsystem being, in turn, dedicated to an I/O function such as concurrent diagnostic or a data processing operation. Each channel processor **114**, of course, services several peripheral subsystems, only one of which is shown in FIG. **2**.

PERIPHERAL SUBSYSTEM HARDWARE CONFIGURATION

Referring now to FIG. 3, the interface circuits between CPU's **110** and **116** and the peripheral device subsystem, including I/O controller **11**, are shown in simplified logic form. Portions of the interfacing circuits pertinent to the practice of the invention are brought out in some detail, while the other interfacing circuits not pertinent to the practice of the present invention, but necessary for effecting interfacing, are shown as a single block in each section. The circuitry represented by logic blocks **150** and **151**, respectively, in interface A and B circuits **152** and **153**, has been used before in a similar two-channel connection between I/O controller **11** and a pair of channels **114** and **118**. Interface circuits A and B are connected to controller circuits **154** (FIGS. **4** and **5**) via "MIS" (multiple interface switch) **155**. MIS **155** selectively connects circuits **154** to CPU **10** via interface A circuits **152** and channel (A) **114**, or to CPU **116** via interface B circuits **153** and channel (B) **118**. Additionally, a neutral position is employed. Channels A and B are connected to other peripheral systems in accordance with known data processing techniques.

I/O controller **11** is connected to a plurality of I/O devices via a set of cables **12** through a subsystem device interface (SDI) **157**. SDI **157** may be constructed in accordance with the teachings of the patent to E. W. Devore, U.S. Pat. No. 3,372,378. In accordance with that patent, additional controllers **158** and **159** are selectively connectable to the plurality of I/O devices through SDI **157**. In turn, CU's **158** and **159** may have separate MIS's for connecting to a plurality of CPU's **160**.

In accordance with known data processing techniques, any of the CPU's **110, 116,** or **160** can connect to any of the I/O devices via SDI **157**. In practicing the present invention in the illustrated environment, concurrent diagnostics on any of the I/O devices and CU's **11, 158,** and **159** may be initiated and supervised by any of the connected CPU's. That is, two of the CPU's **160** may perform diagnostics on CU **158** on a concurrent basis with other tests in the respective CPU's. Additionally, because of SDI **157**, such CPU's can perform concurrent diagnostics with respect to any of the I/O devices connected to SDI **157**. In a similar manner, CPU's **110** and **116** can, on a concurrent basis, perform diagnostics on I/O controller **11** and any of the I/O devices. The same is applicable to CU **159** and the other CPU's **160**.

Before proceeding to the description of the portion of the logic pertaining to practicing the invention in the illustrated environment, the operation of MIS **155** as presently employed in several data processing systems is briefly described. The function of MIS **155** is that of a multiple-pole, triple-throw switch **165**. Effectively, all of the buses and cables interconnecting channels **114** and **118** with I/O controller **111** are switched by **165** through electronic means of known design. In a first position at A, switch **165** interconnects channel **114** to I/O controller circuits **154**. At position C (the neutral position), circuits **154** are disconnected from channels **114** and **118**. At position B, channel **118** is connected to circuits **154**. Switch **165** is actuated by request from channels **114** and **118** as initiated by CPU's **110** and **116**. Since CPU's **110** and **116** operate asynchronously, two requests can be received by MIS **155** at the same time. MIS has priority circuit **166** for assigning priority to one of the two requests. The requests are manifested in the illustration by a select out (SELO) tag signal supplied by channels **114** and **118**, respectively, over cables **168** and **169**. SELO is supplied from those cables to priority circuit **166** via lines **171** and **172**. Additionally, SELO is also supplied to logic circuits **150** and **151** as will become more apparent. Priority circuit **166** responds to SELO on lines **171** and **172** to selectively set selector latch **173** and reset neutral indicating latch **174**. For example, if latch **174** is in the active condition, switch **165** is to terminal C. Upon receiving SELO, priority circuit **166** resets latch **174** to the inactive condition and simultaneously sets latch **173** either to A or B for selectively moving switch **165** to the A or B terminals thereby connecting one of the two interfaces to circuits **154**. In the illustrated system, interface A has priority; hence, if two SELO's are received simultaneously, priority circuit **166** sets latch **173** to condition A. As a result of this selection, an initial selection sequence for channel **114** is performed by circuits **154**. A control unit busy (CUB) signal is supplied to channel **118** indicating the subsystem is not available. Upon completion of an I/O operation, circuits **154** through microprogram means supply a control signal over cable **176** and thence line **177** setting latch **174** to N, thereby moving switch **165** to terminal C. The condition of latch **173** then is ignored until another SELO is received by priority circuit **166**. Under chained operations, circuits **154** are inhibited from setting latch **174** to the active condition, hence, maintaining the operational state of latch **173** in accordance with its setting by circuits **166**.

Once MIS **165** has been actuated to terminal A or B, SELO is supplied through switch **165** to cable **179**, hence, over line **180** to microprocessor circuits within circuits **154** as later described for trapping same to an initial selecting sequence. SELO also travels to interface A and B circuits **152** and **153**, logic **150** and **151**.

Circuits **154**, which include a microprocessor, in response to SELO trap on line **180** supply an address in (ADDRI) initiating signal over cable **176** to either interface circuits **152** or **153** in accordance with switch **165** setting. The respective logic circuits **150** and **151** generate the ADDRI signal for supplying it to the respective channels. Simultaneously, the CUB latches **182** and **183** in the other interface circuits are set to the active condition. These latches supply an activating signal to the encoding circuits **184** and **185** which supply CUB to the respective channels. Encoders **184** and **185** are actuated by a later-described status in (STATIN) signal generated by activity in circuits **154**. STATIN indicates that the set of signals on channel bus in (CBI), later described, indicates the status of the response of the I/O subsystem to a request by the activating channel. In this regard, both interface circuits **152** and **153** include STATIN generators **188** and **189** which generate code permutations for CBI, respectively, for channels A and B in response to instructions received from circuits **154**. STATIN is simultaneously supplied with the code permutations for indicating status of the subsystem.

STATIN generators **188** and **189** generate the STATIN signal through OR circuits **190** and **191**. In usual data processing operations, logic circuits **150** and **151** respectively generate the STATIN signals. In certain situations, AND circuits **192** and **193** generate a STATIN signal. Switched SELO on line **180** is one input to both AND circuits. This indicates that the STATIN tag is generated in response to the SELO after MIS **155** has assigned priorities and effected operations of switch **165**; i.e., STATIN is not generated until circuits **154** can be connected to the selecting channels. The other inputs to AND circuits **192** and **193** are respectively supplied by OR circuits **194** and **195.**

One input signal to both OR circuits **194** and **195** is supplied over lines **197** and **198** entitled "ARM CUB." ARM CUB enables a CUB response to a channel to which the subsystem is chained. Under normal operations, CUB can never be issued to a channel to which the subsystem is chained. This is a technique in concurrent diagnostics enabling a CPU, through its channel, to verify operation of the CUB circuits in the subsystem.

STATIN is also activated whenever circuits **154**, either upon their own initiation or upon receipt of a channel command (including a CCW), perform a general or selective reset. During such a reset operation, an activating signal supplied respectively over lines **200** or **201** to supply STATIN to the initiating channel such that the status, as a result of the reset, can be supplied over CBI for analysis by the respective CPU's. Additionally, STATIN is generated in response to an SELO for presenting initial status over CBI as detected by AND circuits **202** and **203**, respectively, for the two interfaces. These AND circuits are responsive to AB latch **173** being in the appropriate signal state, latch **174** indicating a not neutral connection of switch **165,** and a STATIN generating signal received from circuits **154.**

I/O CONTROLLER 11 AND ITS RELATIONSHIP TO THE SYSTEM

I/O controller **11** operates with the channel described in the Moyer et al., U.S. Pat. No. 3,303,476. FIGS. **1** and 3 of that patent describe all tag signals used herein except SUPPRESSIBLE REQUEST IN which is defined with respect to MPUX (channel MPU) microprograms. It also assumes that the interface between the controller and the I/O devices follows a similar busout, but-in, tag-line arrangement. In addition to the functions described in the Moyer et al. patent supra, a tachometer input line is provided to I/O controller **11**, as later described.

The term "CPU" is hereafter used to include the channel portions of data processors. I/O controller **11** provides control for exchanging informationbearing signals between CPU's and I/O devices, such as magnetic tape units (MTU's) via cable **12** (FIG. 4).

I/O controller **11** has three main sections. MPUX is a microprogrammable unit (MPU) providing synchronization and control functions between the I/O controller **11** and channels **114** and **118.** MPUY performs similar functions with I/O devices via SDI **157.** In a magnetic tape subsystem, MPUY provides motion control and other operational related functions uniquely associated with the I/O device. The third section is data flow circuits **13**, which actually process the information-bearing signals. Data flow circuits **13** may consist of entirely a hardware set of sequences and circuits for performing information-bearing signal exchange operations. In an I/O controller associated with a magnetic tape recording system, such data flow circuits include writing circuits for both PE and NRZI, readback circuits for both encoding schemes, deskewing operations, certain diagnostic functions, and logging operations associated with operating a magnetic tape subsystem.

Since MPUX and MPUY are independently operable, each having its own programs of microinstructions, program synchronization and coordination are provided. To this end, MPUX has exchange registers **14** while MPUY has exchange registers **15.** The signals from the MPU's temporarily stored in these registers are supplied directly to data flow circuits **13** for effecting and supervising data flow and signal processing operations. Additionally, such signals are simultaneously provided to the other MPU. That is, register **15** supplies MPUY output signals to MPUX and register **14** supplies the MPUX output signals to MPUY. The respective MPU's under microprogram control selectively receive such signals for program coordination.

The channels exchange control signals with MPUX over CTO (channel tag out), CTI (channel tag in), CBO (channel bus out), and CBI, plus trap control line **17.** When the trap line is actuated, MPUX aborts all present operations and branches to a fixed address for analyzing signals on CBO. These signals force MPUX to perform channel commands or selected functions. In a similar manner, MPUX has trap control line **18** extending to MPUY. MPUY responds to an actuating signal on line **18** from MPUX in the same manner that MPUX responds to a trap signal on line **17.** MPUY, in addition to exchanging control signals with I/O devices, also has trap line **21** for controlling an I/O device in a similar manner. All information-bearing signals are processed through data flow circuits **13** via full-duplex cables **23** and **24.**

Data flow circuits **13** have CBI lines **30** and CBO lines **31.** Each set of lines has a capability of transferring one byte of data plus parity. Similarly, tape unit bus in (TUBI) lines **32** transfer signals to data flow circuits **13** and MPUY to the I/O devices via SDI **157.** Tape unit bus out (TUBO) lines **33** carry information-bearing signals for recording in MTU's plus commands from MPUY and MTU addresses from MPUX. Status signals are supplied both to MPUX and MPUY over status cables **34** and **35.** Velocity or tachometer signals supplied by the selected and actuated MTU are received over line **36** by MPUX, MPUY, and data flow circuits **13.**

MPUX has output bus **40** (also termed B bus) supplying signals to its exchange registers **14.** These include branch control register **41**, register XA, and register XB. Output bus **40** is also connected to the channel exchanging registers **42.** These registers are CTI and CBI. CBI is channel bus in, while CTI is channel tag in. CTI transfers the tag signals from I/O controller **11** to CPU as described in the Moyer et al. patent and other control signals for interfacing operations.

Additionally, CBO gate **43** receives bytes of data for data flow circuits **13** and for MPUX. Gates XA and XB similarly gate exchange signals from the MPUY exchange registers **15.** Gate XA receives the control signals from register YA while gate XB receives exchange signals from register YB. CBI register is shared by MPUX and data flow circuits **13.** The CBI lines are multiplexed in accordance with the Moyer et al. patent.

CTI supplies tags indicating what the bus in signals mean.

Signals in TUBO register output lines **33** are interpreted by the MTU's in accordance with the signals in TUTAG (tape unit tag) register.

External signals are supplied to MPUX and MPUY via external registers **50** and **51**, respectively. Such external signals may be from another I/O controller, from a maintenance panel, communication network, and the like. Also, hardware detected errors are lodged in register **52** for sampling by MPUX.

I/O controller **11** has an efficient initial selection process. MPUX responds to a channel SELO request for service of an MTU to provide the MTU address over output line **40** into TU address register **60**; from there, the address is sent to all MTU's. The appropriately addressed MTU responds to MPUY that the selection is permissible or not permissible. If permissible, a connection is made; MPUY notifies MPUX via register YA. MPUX then completes the initial selection by responding to the requesting channel via CTI and MIS **155**. Data processing operations then ensue.

MICROPROGRAMMABLE UNITS (MPU'S)

The MPU's contain microprograms which determine the logic of operation of I/O controller **11**. MPUX contains a set of microprograms in its control memory designed to provide a responsiveness and data transfers with the channels. In a similar manner, MPUY contains a set of microprograms for operation with the various MTU's. Registers **14** and **15** contain signals from the respective microprograms which serve as inputs to the respective programs for coordinating and synchronizing execution of various functions being performed. A better understanding of how the microprograms operate the hardware is attained by first understanding the logic construction of the MPU's which are constructed in an identical manner.

Referring more particularly to FIG. **5**, an MPU usable in I/O controller **11** is described in a simplified block diagram form. Data transfers are serially in bytes of eight bits each. The microprograms are contained in read only store (ROS) control memory **65**. While a writable store could be used, for cost-reduction purposes, it is desired to use a ROS type of memory. The construction and accessing of such memories are well known. The ROS output signal word, which is the instruction word, is located by the contents of instruction counter (IC) **66**. IC **66** may be incremented or decremented for each cycle of operation of MPU. By inserting a new set of numbers in IC **66**, an instruction branch operation is effected. The instruction word from ROS **65** is supplied to instruction register (IR) **67** which staticizes the signals for about one cycle of operation. The staticized signals are supplied over cables **68** and **69** to various units in MPU. Cable **68** carries signals representative of control portions of the instruction word, such as the operation code and the like. Signals in cable **68** are supplied to IC **66** for effecting branching and instruction address modifications. Cable **69**, on the other hand, carries signals representative of data addresses. These are supplied to transfer decode circuits **70** which respond to the signals for controlling various transfer gates within MPU. The other portions of the signals are supplied through OR circuits **71** to arithmetic logic unit (ALU) **72**. In ALU **72**, such signals may be merged or arithmetically combined with signals received over B bus **73** for indexing or other data processing operations. MPU has local store register memory (LSR) **75** accessible in accordance with the address signals carried over cable **68**. Address check circuit **76** verifies parity in the address. The address signals may also be used in branch operations. AND circuits **77** are responsive to transfer decode signals supplied from circuits **70** through AND circuits **78** to transfer the address signals in an instruction word to IC **66**. Such transfer may be under direct control of the operation portion of the instruction word as determined by transfer decode circuits **70** or may be a branch on condition (BOC) as determined by branch control circuits **79** which selectively open AND circuits **77** in accordance with the conditions supplied thereto, as will become apparent.

The data flow and arithmetic processing properties of the MPU center around ALU **72**. ALU **72** has two byte inputs, the A bus from OR circuits **71** and B bus **73**. ALU **72** supplies output signals over cable **80** to D register **81**. D register **81** supplies staticized signals over D bus **82** to LSR **75**. Instruction decode circuits **83** receive operation codes from IR **67** and supply decoded control signals over cable **84** to ALU **72** and to AND circuits **78** for selectively transferring signals within MPU.

ALU **72** has a limited repertoire of operations. Instruction decode **83** decodes four bits from the instruction word to provide 16 possible operations. These operations are set forth in the Instruction Word List below:

TABLE I

Instruction Word List

Op Code	Mnemonic	Function
0	STO	Store constant in LSR A set to 0
1	STOH	Store constant in LSR, indexed addressing
2	BCL	Match with Field 1, branch to Addr in Field 2
3	BCH	Match with Field 1, branch to Addr in Field 2
4	XFR	Contents of one selected LSR location is transferred to selected register or selected input is gated to one selected LSR location
5	XFRH	See XFR above plus indexed addressing
6	BU	Branch to 12-bit ROS address in instruction word
7	00	Not used - illegal code
8		A OR'd with B, result stored in LSR 75
9	ORM	A OR'd with B, result not stored
A	ADD	A plus B, sum stored in LSR 75
B	ADDM	A plus B, sum not stored
C	AND	A ANDed with B, result to LSR 75
D	ANDM	A ANDed with B, result not stored
E	XO	A EXCLUSIVE OR B, result to LSR 75
F	XOM	A EXCLUSIVE OR B, result not stored

In the above list, the letter "A" means A register **85**, "B" is the B bus, and the mnemonics are for programming purposes. The term "selected input" indicates one of the hardware input gates (**92, 94, 96, 98**) to the ALU output bus **80**. The term "selected register" indicates one of the "hardware" registers in MPU. These include the interconnect registers **14** and **15** (FIG. **4**), tag register **74**, bus register **99**, address register **60**, and

IC 66. Note that the transfers from LSR 75 to these selected registers are via B bus 73. In FIG. 4, the B bus for MPUX corresponds to cable 40, while the MPUY B bus is cable 40A. Registers 14 receive signals via AND circuits 86 and 87. In MPUY, AND circuits 86 and 87 supply signals to exchange registers 15. Branch control 79 in FIG. 5 is the internal branch control. Branch controls 41 and 41A of FIG. 2 supply their signals respectively over cables 88 and 87A to the respective MTU's. These branch controls are separate circuits. Tag register 74 in FIG. 3 for MPUX corresponds to CTI register in the channel exchange registers 42. For MPUY, it corresponds to TUTAG register connected to SDI 157. In a similar manner, bus register 99 for MPUX is register CBI in channel exchanging registers 42, while in MPUY it is register TUBO. Address register 60 of FIG. 5 corresponds to TU address register 60 of FIG. 4. MPUY address register 60 is not used.

Status register 89 has several output connections from the respective MPU's. It is divided into a high- and low-order portion. The high-order portion has STAT (status) bits 0–3, while the low-order portion has STAT bit 0 plus STAT bits 4–7 (referred to as STAT A through STAT D, respectively). The low-order portion is supplied to the branch control 79 of the other MPU's. The bits 0 and 4–7 are supplied to the data flow. Bit 7 additionally is supplied directly to the ALU 72 of MPUY as indicated by lines 90 in FIG. 4. This corresponds to a self-trapping operation which will be later described. Interpretation of the STAT bits is microprogram determined.

The signal-receiving portions of each MPU are in four categories. First, bus register 91 is designed to receive tags and data bytes for MPUY; this corresponds to CBO register 43 of FIG. 4. An MPUY bus register 91 is TUBI register. AND circuit 92 is responsive to the transfer decode signals from circuits 70 to selectively gate bus register 91. From thence, the data bytes are supplied to LSR 75. Secondly, D register 81 also receives inputs from hardware error register 93 via AND circuits 94. Hardware error signals (parity errors, etc.) are generated in circuit 95 in accordance with known techniques. Thirdly, AND circuits 96 receive external data signals over cable 97A for supplying same to D register 81 under microprogram control. Fourthly, interchange registers 14 and 15 respectively supply signals to pairs of AND circuits 98 which selectively gate the interchange signals to D register 81 under microprogram control. The receiving microprogram controls the reception of interchange signals from the other MPU.

Generally, the outgoing signals from each MPU are supplied via B bus 73, also a main input bus to ALU 72. The signal-receiving bus is the D bus, which is the input bus for LSR 75 and the output bus for ALU 72.

Since ALU 72 has a limited repertoire of operations, many of the operations performed are simple transfer operations without arithmetic functions being performed. For example, for OP code 4, which is a transfer instruction, the contents of the addressed LSR are transferred to a selected register. This selected register may be A register 85 in addition to the output registers. To add two numbers together in ALU 72, a transfer is first made to A register 85. The next addressed LSR is supplied to the B bus and added to the A register contents with the result being stored in D register 81. At the completion of the ADD cycle, the contents or result of D register 81 are stored in LSR 75. If it is desired to output the results of the arithmetic operation, then another cycle is used to transfer the results from LSR 75 over B bus 73 to a selected output register such as one of the interchange registers or bus register 99.

In FIG. 5, the input to D register 81 is either cable 44 or 44A of FIG. 4. Hardware error circuits 95 and error register 93 of FIG. 5 correspond both to the hardware error circuits 52 and 52A of FIG. 4. External cables 97A receive signals from the external registers 50 and 51 respectively for the two MPU's.

AND circuits 98 of FIG. 5 correspond to the gates XA, XB, YA, and YB of FIG. 4.

Each MPU is trapped to a predetermined routine by a signal on trap line 17 or 18, respectively; the trap signal forces IC 66 to all zeroes. At ROS address 000, the instruction word initiates X-trap routine or Y-trap routine (FIG. 6). For reliability purposes, it is desirable to force MPUY to inactivity. This means that clock or oscillator 48 is gated to an inactive state. During normal operations, clock 48 supplies timing pulses to advance IC 66 and coordinate operations of the various MPU's as is well known. Whenever MPUY has finished its operations, it sets STAT D in register 89. STAT D indicated MPUY has finished its operations as requested by MPUX. The STAT D signal sets hold latch 99A indicating that MPUY is inactive. Hold latch 99A gates clock 48 to the inactive condition. When MPUX traps MPUY, not only is IC 66 preset to all zeroes, but hold latch 99A is reset. Clock 48 is then enabled for operating MPUY.

MICROPROGRAMMING GENERALLY

FIG. 6 shows general relationships between the micro-routines of MPUX and MPUY. This showing is greatly simplified to give a general impression of how the micro-routines cooperate to perform I/O controller functions. Many of the functions performed by these micro-routines have been performed before in other I/O controllers, usually by hardware sequences. Some micro-routines of lesser importance to the present invention have been omitted for clarity. The described routines were selected to illustrate the operating relationships of MPUX, MPUY, data flow circuits 13, MTU's, and CPU in evaluating subsystem performance by concurrent diagnostics as more clearly brought out later.

X-idlescan 120 and Y-idlescan 121 monitor pending status, interrupt status, and provide intercommunication between the two MPU's for ascertaining availability of the I/O devices. X-idlescan 120 includes trapping MPUY via Y-idlescan 121 for polling I/O devices via SDI 157 to determine availability of an addressed MTU. Included in X-idlescan is a wait routine which idles MPUX until trapped by a channel. The channel traps MPUX to ROS 65 address 000. At MPUX ROS address 000, X-trap 122 begins. During the execution of X-trap routine 122, MPUY is trapped to ROS address 000 to later execute Y-trap routine 123. In X-trap 122, CTO is sensed for initial selection. If the initial selection tag is active, X-trap routine branches the microprogram to X-initial selection 125. If there is no initial selection, then either X-RESET 126 or an ALU diagnostic within diagnostic routine 127 is performed. Diagnostic routine is shown in part in flowchart form in FIG. 7. Upon completion of these functions, X-idlescan

120 may be re-entered to complete MTU scanning operations. Initial selection **125** is responsive to certain hardware errors received at **128** (sensed as described with respect to FIG. 3) to stop I/O controller **11** for indicating detected hardware errors.

During an initial selection, X-polled **129** is entered to further identify the channel request. Also, certain branch conditions are set up in LSR for use later by X-termination **130.** MTU address verification may be performed. Upon completion of the branch setups, the X-polled **129** initiates X-status **132.** X-status **132** activates CTI to send tag signals to the channel interface indicating controller status in response to the previously received requests. Based upon the branching set up in X-polled **129,** the microprogram execution may follow several routes. These primarily end up in X-termination **130** which terminates the MPUX operation. MPUX then scans for further interrupts. With all scanning completed, MPUX waits for further instructions from either channel **114** or **118.**

Another routine is service return (SERVRTN) **135** used in conjunction with the channel interface circuits **152** and **153** for timing and control purposes during data transfers. The operation of the above-referred-to data channel in Moyer et al. is implemented by SERVRTN **135.** Another possible routine entered from initial selection **125** is X-mode **136,** which determines the mode of operation in the controller in response to channel CMDO (command out) signals. X-read type and test **137** is entered in the event the initial selection results in a read operation. X-read type and test **137** traps MPUY to predetermined ROS control memory addresses for initializing a read operation, within MPUY. In a similar manner, X-write **138** is entered and also traps MPUY to another subroutine for initializing a write operation. Error status **139** transfers error information to CPU. This routine is closely associated with initializing I/O controller **11** for read and write. Sense **140** is entered in response to a channel sense command. Sensing transfers sense bytes to CPU for analysis. X-termination **130** also traps MPUY in connection with the selecting activated MTU's and for performing other functions in connection with terminating an operation previously initiated through a channel. MPUY micro-routines respond to MPUX microroutines for controlling various MTU's via SDI **157.** These micro-routines also transfer information control signals, I/O devices, and SDI **157** to MPUX for retransmittal to channel and CPU. Upon being trapped by MPUX, Y-trap **123** obtains an MPUY ROS address from XB register and then branches to that address. Such ROS addresses are the first instruction address of several MPUY microprograms. For example, one address initiates diagnostic **142.** Diagnostic **142** may initiate one of several microprograms for effecting operations in CU **11** or an MTU for diagnostic purposes. Such program connections are not shown.

On the other hand, Y-trap routine **123** may branch to Y-initial selection **148** to initialize MPUY for activity set forth in additional control signals from MPUX in registers **14.** This may include an initiation of status **149,** termination **147,** or Y-idlescan **121.** The MTU operating routines **143–146** may also be initiated from initial selection **148.** In addition to exchanging control signals via registers **14** and **15,** status information is freely exchanged between the two MPU's for microprogram coordination.

MICROPROGRAM SEQUENCE FOR MPUX ENABLING CONCURRENT DIAGNOSTICS

A simplified flowchart later shows microprogram flow for setting and sensing chained and diagnostic flags effecting concurrent diagnostics. MPUY microprograms are subservient to the described microprogram for effecting certain diagnostic functions not necessarily associated with enabling concurrency and, therefore, are not described. LSR **75** in MPUX retains diagnostic and operating flags upon which the microprograms branch to various sequences for effecting the designated concurrent operations. For ease of reference, a partial LSR map for control flags in MPUX LSR **75** is set forth below:

TABLE II

Selected Diagnostic Flags	
Register and Bit	Flag
4-0	DIAG MODE
4-1	BLK INT
4-2	FORCE DVE BSY
4-3	ARM CUB
4-4	BLK UC
4-5	
4-6	
4-7	
Selected Operation Flags	
Register and Bit	Flag
5-0	CHAIN A
5-1	CHAIN B
5-2	REW/DSE
5-3	OP COMPLETE
5-4	UNIT CHECK
5-5	ENABLE
5-6	
5-7	
6-0	OPIN
6-1	STATIN
6-2	CUB-A
6-3	CUB-B
6-4	ADDRI
6-5	SVCI
6-6	CUR
6-7	DE
7-0	DEPRIME
8-0	DEPRIME

In the flowchart below, each major sequence step is listed, followed by the description. Entry to the various sequence steps is from the immediately preceding step unless otherwise indicated after the word "Enter." Exit from the sequence step is to the immediately following listed sequence step unless otherwise indicated. The function is described in abbreviated form indicating the function performed during the particular step. That is, each step represents several micro-instructions in MPUX, the exact code listing being one of programming design not necessary to practicing the present invention. Following the flowchart, a brief description ties selected steps of the microprogram flowchart into the functions performed for concurrent diagnostics. Reference to particular steps in this flowchart will be by reference to sequence step number.

SEQUENCE STEP M1 - X-IDLESCAN 120

Enter From: M19 when $\overline{\text{DE STS}}$ ≠ ; M16 when $\overline{\text{CHAIN}}$ (entry from M16 only when not chained).

Function: Scans to find pending status in subsystem such as interrupts, device ends, etc.

Exit To: M2 at end of scan or detection of interrupt, device end, or status to be reported to CPU, raise REQIN upon exit; M3 when trapped by channel or hardware.

SEQUENCE STEP M2 — X-IDLEPEND (A PART of X-IDLESCAN 120)

Enter From: M1; M20 when $\overline{\text{SUPPRO}}$ (M20 entry only when SUPPRO from channel is inactive which indicates channel has completed its sequence).
Function: Wait for channel SELO.

SEQUENCE STEP M3 — X-TRAP 122

Enter From: By trap only.
Function: On trap by channel, logic **150** or **151** set branch conditions in branch control **41.** Microprogram scans these branch conditions to enter a microprogram corresponding to a channel command.

SEQUENCE STEP M4 — INITIAL SELECTION 125

M4A Function: Perform initializing functions as described in patents showing channel operations. Below are particular functions related to concurrent diagnostics as implemented in I/O controller **11.**

M4B Function: BOC Not Chained, Go to M4C; BOC Chained, skip M4C, go to M4D (maintain diagnostic mode). (Never chained on first command of a chained sequence).

M4C Function: Reset all LSR diagnostic flags. This is done on first command of any chained sequence initiated by an SIO (start I/O). See remarks of effect on concurrent diagnostics. Since chaining has been broken, CPU is indicating to I/O controller that the diagnostic procedures have been completed. Accordingly, all diagnostic flangs including BLT INT are reset for enabling usual data processing operations.

M4D Function: Initial status bytes from LSR **75** are transferred to CBI with STATIN activated on CTI in accordance with patents describing channel operations. The chained condition in I/O controller **11** is reset if SUPPRO is inactive and continues set if SUPPRO is active. This enables the CPU to either selectively continue the chain or break it after execution of the command in step M5. CUB is activated in the channel interface not chained.

SEQUENCE STEP M5

Function: Detect for a rewind (REW) or data security erase (DSE).
Exit: **0** exit to M10 for executing command. **1** continue on testing chain.

SEQUENCE STEP M6

Function: Test for chained condition in an interface.

Exit: **0** exit to M9. **1** continue testing for forcing unusual conditions on interface.

SEQUENCE STEP M7

Function: Test LSR flag to see if device busy (DVE BSY) is to be sent to CPU. **1** exit to M10 for executing command. **0** perform M8.

SEQUENCE STEP M8

Function: Set LSR hold status. This status indicates a free-standing or time-consuming operation to be performed by an I/O device upon completion of initiation of I/O device function. CU will continue to do other things and will not send ending status to channel for device until a DVE is received.

SEQUENCE STEP M9

Function: Set LSR REW/DSE FLG. This indicates to the microprogram that an REW/DSE is being performed by the addressed MTU. There is one flag for each I/O device or MTU. This flag is used during IDLESCAN **120** for checking whether or not the REW/DSE is still being performed by the addressed MTU.

SEQUENCE STEP M10

Function: Executes channel command. This may be a read, write, sense, or print in accordance with I/O subsystem functions as related to the CPU.

SEQUENCE STEP M11

Function: Sense for REW/DSE. **0** exit to M13 for assembling ending status (do not have to wait for completion of I/O device operation). **1** exit to M12.

SEQUENCE STEP M12

Function: Check for DVE from device doing REW/DSE.
Exit: **0** device has completed free-standing operation. Return to **1** for scanning activity of other devices. **1** wait loop for completion of I/O device operation.

SEQUENCE STEP M14

Function: Assemble ending status. Various indicators in LSR **75,** as well as latches in CU, are sensed and assembled into a fixed number of sense bytes for transmittal to the I/O channel simultaneously with STATIN in step M15.

M14A Function: Sense for block interrupt flags, i.e., determine whether or not the unit check (UC) can be sent to channel.
Exit: **1** exit directly to M15 for sending ending status to CBI. **0** block interrupt is off, CU must check for UC condition.

M14B Function: Check LSR **75** for "send UC" flag.

Exit: **0** not UC, exit directly to M15. **1** UC condition is sensed without a block interrupt. Exit to M14C for adding UC to ending status.

M14C Function: UC sense bit in LSR status byte is set in preparation for sending UC status to channel in CPU.

SEQUENCE STEP M15

Enter: Steps M14A, B, or C.
Function: Transfer status information to CPU. Status byte from LSR **75** is supplied to CBI while simultaneously STATIN bit is activated on CTI. If SUPPRO is received from connected channel, the chaining latch in CU is set for continuing the diagnostic or chaining operation.

SEQUENCE STEP M16

Function: Check for chaining condition.
Exit: **0** return to M1 for IDLESCAN operation, i.e., all channel commanded functions have been completed. **1** continue on chained operation.

SEQUENCE STEP M17

Function: Reset all CTI's.

SEQUENCE STEP M18

Function: Check for ARM CUB flag.
Exit: **0** to **M20. 1** exit to **M19.**

SEQUENCE STEP M19

Function: ARM CUB sets flag in LSR **75** for supplying a CUB signal in response to the next received channel command (note that chained condition is maintained).

SEQUENCE STEP M20

Function: Since chain command has been received, SUPPRO is active. Wait loop in **M20** until SUPPRO is deactivated, then go to step **M2.**

With regard to the above flowchart, in step **M4B**, the CU will never be chained if the command being received is the first command in a set of chained commands or the only command. Accordingly, the block interrupt flag (BLK INT FLG), as well as all other diagnostic flags, is reset in step **M4C.** To maintain the BLK INT FLG during a chained diagnostic operation for preventing the control unit from interrupting with ending device status, all SIO's must have a SET DIAGNOSE command with a channel control word (CCW) indication BLK INT FLG being set. This set of operations interlocks the diagnostics from other data processing operations which are operating concurrently. Data processing operations, whether or not chained, do not use SET DIAGNOSE; and, therefore, the BLK INT FLG will never be set during normal data processing operations. Also, upon dropping a chained condition by not supplying SUPPRO, the block interrupt and other diagnostic flags are reset enabling the CU to return to data processing operations. Accordingly, the BLK INT FLG will only be activated from the SET DIAGNOSE following an SIO to the beginning of the next SIO.

MPUX (ALU-1) PARTIAL MICROCODE LISTING

```
LOC  OBJECT     STMT   SOURCE STATEMENT
                  985+*************************************************************
     CODE         986+*    ALU2 IS ALWAYS SLAVED TO ALU1. ANY OPERATION EXECUTED BY ALU2     *
                  987+*    MUST ALWAY BE INITIATED BY ALU1 VIA A XOUTB. THE XOUTB BY ALU1    *
                  988+*    TRAPS ALU2 TO LOCATION 000. ALU2,BEGINNING EXECUTION AT 000,      *
                  989+*    FETCHES AN INDEX BYTE FROM ALU1 AND MOVES IT TO THE INSTRUCTION   *
                  990+*    COUNTER. THE INDEX BYTE WILL POINT TO ONE OF THE BRANCH INSTRUCT- *
                  991+*    IONS IN THE BRANCH TABLE. THE SELECTED BRANCH INST WILL BE        *
                  992+*    FXECUTED AND THE DESIRED ROUTINE WILL BE ENTERED. WHEN THE        *
                  993+*    SELECTED ROUTINE COMPLETES, STAT D WILL BE SET INDICATING TO      *
                  994+*    ALU1 THAT THE DESIRED FUNCTION HAS BEEN COMPLETED. ALU2 WILL THEN *
                  995+*    BE HELD AT LOCATION 000 UNTIL ACTUATED BY ALU1 VIA XOUTB TRAP     *
                  996+*************************************************************

000000 5788        999 BYPASS    XFR   WORK2,XINB          FETCH ALU1 INDEX
000001 0800       1002           STO   STATIMG,ZERO        CLEAR STAT IMAGE REG
000002 1800       1005           STOH  STATIMG,0            CLEAR STAT IMAGE REG HIGH
000003 4828       1008           XFR   STATIMG,STAT        CLEAR ANY OUTSTANDING STATS
000004 5722       1011           XFR   WORK2,IC            MOVE INDEX TO INST CTR
000005 6000       1014 NDXTST3   BU    EXECTST3            GO DO ALU 2 CHECKOUT
000006 6000       1017 NDXDES    BU    EXECDES             HIO NOT OPRTING--GO DESELECT TU
000007 6000       1020 NDXPOLL   BU    EXECPOLL            GO POLL DEVICE FOR STATUS
000008 6000       1023 NDXGRST   BU    EXECGRST            GO DO GENERAL RESET
000009 6000       1026 NDXSRST   BU    EXECSRST            GO DO SELECTIVE RESET
00000A 6000       1029 NDXSDE    BU    EXECSDE             GO SET DEVICE END
00000B 6000       1032 NDXABRT   BU    EXECABRT            GO STOP THE DEVICE IF GOING
00000C 6000       1035 NDXDMR    BU    EXECDMR              GO DO DIAG MEASERE
00000D 6000       1038 NDXAXESS  BU    ACCESS              GO GET READ ACCESS TIME
00000E 4990       1041 NDXFLAGS  XFR   FLAGS,XINA          BRING IN FLAG BYTE
00000F            1043+NDXSNSR   EQU   *
00000F 6000       1045 SRETURN7  BU    ZAP1M           USE ON SENSE RESET & SEL RESET RETURN
000010 4090       1048 NDXFLAG2  XFR   WORK5,XINA          GET TUBO MASK (SET FLAGS #3)
000035            1050+NDXFSF    EQU   X'35' .             GO DO FORWARD SPACE FILE
000031            1051+NDXERS    EQU   X'31' .             GO DO ERASE TO END OF TAPE(EOT)
000037            1052+NDXFSR    EQU   X'37' .             GO DO FORWARD SPACE RECORD
000033            1053+NDXRDF    EQU   X'33' .             GO DO READ FORWARD
00003C            1054+NDXBSF    EQU   X'3C' .             GO DO BACKSPACE FILE
00003E            1055+NDXBSR    EQU   X'3E' .             GO DO BACKSPACE RECORD
00003A            1056+NDXRDB    EQU   X'3A' .             GO DO READ BACKWARD
000013            1057+NDXWRT    EQU   X'13' .             GO DO WRITE OPERATION
000020            1058+NDXWTM    EQU   X'20' .             GO DO WRITE TAPE MARK
000022            1059+NDXERG    EQU   X'22' .             GO 40 ERASE RECORD GAP
00002F            1060+NDXRWD    EQU   X'2F' .             GO DO REWIND
000029.           1061+NDXRWU    EQU   X'29' .             GO DO REWIND UNLOAD
0000ED            1062+NDXSTS    EQU   X'ED' .             GO DO INITIAL STATUS
0000E1            1063+NDXSNS    EQU   X'E1' .             GO DO SENSE OP
000000            1065 BEGIN     CSECT
                  1066 */*     ALU1: BEGIN    */
                  1067 *** POWER ON RESET IS CHECKED FIRST TO INSURE THAT LSRS HAVE GOOD
                  1068 *** PARITY PRIOR TO THE ENSUING ALU OPS.
000000 2F14       1070 CHKRSTS   BOC   PWRRST,EXECRST      BRANCH IF POWER ON RESET
000001 3C04       1073           BOC   NGENR,NORESETS      BRANCH IF NOT GENERAL RESET
000002 C1F0       1076           AND   CTIMAGE,X'F0'       CLEAR CHANNEL TAGS
000003 4150       1079           XFR   CTIMAGE,CTI         SET TO HARDWARE
```

```
                  1082 ****************************** ALU FAIL CHECK *************************
                  1083 *  EACH TIME ALU1 IS TRAPPED TO LOC 0, THE ALU HARDWARE ERROR.REGS ARE*
                  1084 * TESTED FOR A FAILURE. THE TWO EXCEPTIONS ARE:                       *
                  1085 *          1. POWER ON RESET                                          *
                  1086 *          2. A PRIOR FAILURE THAT HAS NOT BEEN CLEARED BY A SENSE OP *
                  1087 *  ONCE A FAILURE HAS BEEN DETECTED, THE ALU ERROR REGS ARE SAVED IN *
                  1088 * LSRS AND WILL REMAIN UNTIL A SENSE OP IS ISSUED. THE ALUFAIL FLAG  *
                  1089 * PREVENTS OVERLAYING THE LSRS WHEN THEY ARE HOLDING PRIOR ERROR DATA *
                  1090 *  THE FIRST SIO/TIO (OTHER THAN SENSE) SUBSEQUENTLY ISSUED TO THE   *
                  1091 *CONTROLLER AFTER AN ALU FAILURE WILL BE UNIT CHECKED. SUCCEEDING    *
                  1092 * SIO/TIO'S WILL RECEIVE AVAILABE STATUS IF THE ONLINE PROGRAM CHOOSES*
                  1093 * TO IGNORE THE INITIALLY UNIT CHECKED SIO/TIO.                       *
                  1094 ***********************************************************************

000004 0200       1097 NORESETS STO   XOUTAIM,0          CLEAR DATA FLOW CROSSOVER
000005 DB40       1100          ANDM  FLAGS2,ALUFAIL     MASK FOR PREVIOUS ALU FAILURE
000006 310A       1103          BOC   DREG1,ANYMOR       BRANCH IF THERE WAS
000007 5681       1106          XFR   ALU2ERR,EXT        FETCH ALU2 HARDWARE ERRORS
000008 5584       1109          XFR   ALU1ERR,HDWR       FETCH ALU1 HARDWARE ERRORS
000009 2218       1112          BOC   ALUR,HNDLERR       BRANCH IF ANY ALU ERRORS
00000A 221D       1115 ANYMOR   BOC   ALUR,CLEARIT       BRANCH IF ERROR TO CLEAR
00000B 140B       1118 SETABRT  STO   XOUTBIM,NDXABRT-ALU2BRT  SET XOUTB IMAGE FOR USE LATER
00000C CBC0       1121          AND   FLAGS2,X'C0'       CLEAR FRU REG(EXCEPT FAIL FLAGS)
00000D CAF0       1124          AND   REQTAGS,ONES-15    MASK ALL REQUEST DOWN
00000E 4A48       1127          XFR   REQTAGS,MIST       RESET TO HDWE
00000F 2381       1130          BOC   MIFTR,MIFTR12      BRANCH IF MIS AVAILABLE     ***
000010 8180       1133 SETHOLDA ORI   CTIMAGE,HOLDA      RAISE CHAINING HOLD LINE
000011 3D21       1136 CHKISEL  BOC   ISEL,INSELCHK      BRANCH IF CHANNEL POLL OR SELECT
000012 5441       1139          XFR   XOUTBIM,XOUTB      TRAP ALU2 TO INITIALIZE
000013 3C15       1142          BOC   NGENR,CKSELRST     BRANCH IF NOT GENERAL RESET
000014 635B       1145 EXECRST  BU    GENRESET           GO DO GENERAL RESET

000015 2C17       1149 CKSELRST BOC   SELRST,SELRTNO     DO SELECTIVE RESET ROUTINE.
000016 6513       1152 GODOALU  BU    ALUCHECK           DO ALU CHECKOUT.

000017 6366       1156 SELRTNO  BU    SELRESET           GO DO SELECTIVE RESET

000018 1D00       1160 HNDLERR  STO   FRUREG,0           CLEAR SENS FRU REG
000019 4B21       1163          XFR   FLAGS2,AR          MOVE FAIL INDICATOR TO ALU A REG
00001A 5006       1166          XFRH  LSR                SET HIGH LSR'S
00001B 8D00       1169          ORI   FRUREG,0           MOVE FAIL IND. INTO SENSE FRU REG
00001C 4006       1172          XFR   LSR                SET LO LSRS
00001D 8BC0       1175 CLFARIT  ORI   FLAGS2,ALUFAIL+FORCEUC OTHERWISE SET FAIL FLAGS
00001E 2C17       1178          BOC   SELRST,SELRTNO     BRANCH IF SELECTIVE RESET
00001F 4012       1181          XFR   CLEAR              CLEAR THE ERROR
000020 600B       1184          BU    SETABRT            RETURN TO MAINLINE

                  1187 ***********************************************************************
                  1188 * WHEN INSELCHK IS REACHED WE HAVE BEEN TRAPPED FOR INITIAL SELECTION *
                  1189 * OR A POLL. IF ADDRESS OUT IS UP---INITIAL SELECTION IS INDICATED.  *
                  1190 ***********************************************************************

000021 287F       1193 INSELCHK BOC   ADROUT,SIORTN      BRANCH IF SIO.  IF NOT, POLL ACC
000022 D906       1196          ANDM  FLAGS,STATPNDG+STACK TEST FOR PENDING ORASTACK
000023 2025       1199          BOC   DBUS,POLLED        BRANCH IF NOT PNDG OR STACK.
000024 6029       1202          BU    INTFCHK            GO HANDLE PENDING STATUS

                  1205 ***********************************************************************
                  1206 *  POLL ACCEPTED. IF STATUS IS PENDING OR STACKED THE PENDING ADDRESS *
                  1207 * REG IS USED TO VERIFY THE CORRECT CHANNEL. OTHERWISE THE
                  1208 * CONTROL UNIT ADDRESS FOR THE CHANNEL POLLING IS MOVED FROM CHANNEL  *
                  1209 * BUS OUT TO THE PENDING ADDRESS REG. IF STATUS IS DUE TO A SECURITY  *
                  1210 * DEVICE END OR DEVICE END DUE TO A PRIME, ALU2 WILL BE SPINNING     *
                  1211 * WAITING TO CLEAR THE DEV END CONDITION IF CHANNEL ACCEPTES STATUS.  *
                  1212 ***********************************************************************

000025 43A0       1217 POLLED   XFR   CURADDR,CBO        GET CU ADDRESS FROM HARDWARE
000026 C60F       1220          AND   PNDADDR,X'0F'      CLEAR HIGH ORDER
000027 4321       1223          XFR   CURADDR,AR         MOVE CU ADDRESS TO ALU INPUT REG
000028 8600       1226          ORI   PNDADDR,ZERO       MERGE DEV AND CU ADDRESSES

000029 4660       1230 INTFCHK  XFR   PNDADDR,CBI        MOVE ASSEMBLED ADDRESS TO CHAN BUSIN
00002A 8103       1233          ORI   CTIMAGE,ADDIN+OPIN RAISE OP AND ADDRESS IN
00002B 4150       1236          XFR   CTIMAGE,CTI        SET TO HDWE
00002C C1FD       1239          AND   CTIMAGE,ONES-ADDIN RESET ADDRESS-IN IN  IMAGE REG
                  1241 *** IF MIS GO CHECK FOR PROPER INTERFACE POLLING
00002D 230A       1243          BOC   MIFTR,MIFTR00      BRANCH IF MIS AVAILABLE     ***

                  1246 *** CHECK TO SEE IF CONTROL UNIT END SHOULD BE ADDED TO STATUS
00002E D940       1248 NOTBINT1 ANDM  FLAGS,CUEA         MASK FOR CONTROL UNIT END A
00002F 2031       1251          BOC   DBUS,MOVEOUT       BRANCH IF OFF

000030 8520       1255 DOACUE   ORI   PNDSTS,CUE         SET CUE IN STATUS

000031            1258 MOVEOUT  EQU   *
000031 1048       1260 SETLINK  STO   LINK1,SRETURN0     ACCEPTED STATUS RETURN
000032 1149       1263          STO   LINK2,SRETURN1     STACK STATUS RETURN
000033 12AD       1266          STO   LINK3,PRETURN0     HALTI/O RETURN NOT OPERATING
000034 294E       1269 CMOUP    BOC   CMDOUT,RSTADDIN    WAIT COMMAND OUT RISE
000035 28AD       1272          BOC   ADROUT,PRETURN0    BRANCH IF HIO
000036 6034       1275          BU    CMOUP              WAIT
                  1278 ***********************************************************************
                  1279 * ENTRY TO THIS SUBROUTINE IS FROM: CONTINIT AND CLEANIT AND MODELINK *
                  1280 * PRIOR TO PRESENTING INITIAL STATUS TO CHANNEL. IF CHAINING IS NOT IN*
                  1281 * EFFECT THE FIRST TWO DIAGNOSTIC FLAG BYTES WILL BE CLEARED AND BYTE0*
                  1282 * PASSED TO ALU2.                                                     *
                  1283 ***********************************************************************
```

```
000037 6306       GRETURNO BU     CHEKSNS              RETURN FOR MODE CMDS

000038 134E       GODODIA0 STO    LINK4,STATRTN-BEGIN SET CTL AND BURST CMD RETURNS
000039 D901       GODODIA  ANDM   FLAGS,CHAIN          MASK FOR CHAIN FLAG
00003A 3741                BOC    DREG7,ALU2DIA        BRANCH IF ON
00003B F0BB                XOM    CURCOMM,X'BB'        MASK FOR LWR COMMAND
00003C 2041                BOC    DBUS,ALU2DIA         BRANCH IF SO
00003D F00B                XOM    CURCOMM,X'0B'        MASK FOR DIAG WRT
00003E 2041                BOC    DBUS,ALU2DIA         BRANCH IF SO
00003F 0C00                STO    SETDIA1,0            CLEAR FLAG BYTE ONE
000040 0D00                STO    SETDIA2,0            CLEAR FLAG BYTE TWO
000041 4C42       ALU2DIA  XFR    SETDIA1,XOUTA        MOVE FIRST FLAG BYTE TO ALU2
000042 8801                ORI    STATIMG,SETSTATD     SET STATD TO INDICATE SNS RESET
000043 4828                XFR    STATIMG,STAT         SET TO HARDWARE
000044 C8FE                AND    STATIMG,ONES-SETSTATD RESET STAT D IN IMAGE REG
000045 170E                STO    WORK2,NDXFLAGS-ALU2BRT FETCH ALU2 SET DIAGNOSE INDEX
000046 5741                XFR    WORK2,XOUTB          KICK ALU2 OFF TO FETCH BYTE
000047 5322                XFR    LINK4,IC             RETURN TO INITIAL STATUS
                  ***************************** STATUS SUBROUTINE ****************
                  *  THE STATUS ROUTINE HANDLES INTERLOCKING OF INTERFACE LINES AND      *
                  * BRANCHES TO THE APPROPRIATE SUBROUTINE DEPENDING ON THE CHANNEL      *
                  * RESPONSE TO STATUS IN. THE INTERFACE WILL ALSO BE MONITORED FOR A    *
                  * HIO CONDITION AND THE LINK RETURN WILL BE EXECUTED IF HIO SHOULD     *
                  * OCCUR. IF THE CHANNEL ERRONEOUSLY STACKS CLEAN INITIAL STATUS A      *
                  * HANG WILL OCCUR IN THE INTFERR LOOP                                  *
                  ************************************************************************

000048 62CD       SRETURN0 BU     TERMACC              RETURN FOR ACCEPTED STATUS
000049 62C7       SRETURN1 BU     TERMSTAK             RETURN FOR STACKED STATUS
00004A 6183       SRETURN2 BU     SENSE0               RETURN TO SENSE ROUTINE
00004B 6237       SRETURN4 BU     CONTSERV             RETURN FOR SERVICE
00004C 6238       SRETURN5 BU     CONTSTAK             RETURN TO STACK
00004D 65A1       SRETURN6 BU     CLEANGO              RETURN FOR ACCEPTED STATUS

00004E            STATRTN  EQU    *                    DEFINE ENTRY POINT
00004E 4150       RSTADDIN XFR    CTIMAGE,CTI          RESET ADDRESS-IN TO HDWE
00004F            STATRTN1 EQU    *                    DEFINE ENTRY POINT
00004F 287A       SVCOUTUP BOC    ADROUT,HIOLINK       HALT I/O LINK
000050 204F       CMDOUTUP BOC    SVCOUT,SVCOUTUP      SVC OUT UP WAIT FOR DROP
000051 294F                BOC    CMDOUT,SVCOUTUP      CMD OUT UP WAIT FOR DROP
000052 4560                XFR    PNDSTS,CBI           MOVE STATUS TO BUS IN
000053 8104                ORI    CTIMAGE,STSIN        MASK STATUS IN TAG UP
000054 4150                XFR    CTIMAGE,CTI          RAISE STATUS IN
000055 C1FB                AND    CTIMAGE,ONES-STSIN   MASK STATUS IN DOWN
000056            INTFERR  EQU    *                    RETURN FOR STACKED CLEAN INIT STS
000056 287B       WATESUM  BOC    ADROUT,HIOLINK1      HALT I/O LINK
000057 295B                BOC    CMDOUT,STAKLINK      STACK LINK
000058 2D69                BOC    SVCOUT,TAKELINK      ACCEPT LINK
000059 6056                BU     WATESUM

                  ************************************************************************
                  *THE STAKLINK OCCURS WHENEVER COMMAND OUT ANSWERS STATUS IN. THE STACK*
                  *FLAG IS SET FOR NON-STACKABLE STATUS AND LINK2 RETURN EXECUTED.      *
                  * CHAINING IS RESET FOR ALL STATUS EXCEPT A CHANNEL END ALONE (CONTROL*
                  * CMD INITIAL STATUS)                                                 *
                  ************************************************************************

00005A 4150       STAKDISC XFR    CTIMAGE,CTI          RESET OP IN RAISE CUB

00005B C9FE       STAKLINK AND    FLAGS,ONES-CHAIN     RESET CHAIN BIT
00005C F504                XOM    PNDSTS,DEVEND        MASK FOR DEV END ALONE STATUS
00005D 2066                BOC    DBUS,NOSTACK         BRANCH IF SO
00005E F506                XOM    PNDSTS,DEVEND+UNITCHK  IS STATUS READY DROP ON REW/DSE
00005F 2066                BOC    DBUS,NOSTACK         BRANCH IF YES TO PREVENT STACK
000060 F510                XOM    PNDSTS,BUSY          MASK FOR BUSY ALONE IN STATUS
000061 2066                BOC    DBUS,NOSTACK         BRANCH IF IT IS TO PREVENT STACK
000062 F520                XOM    PNDSTS,CUE           IS IT CUE ALONE
000063 2066                BOC    DBUS,NOSTACK         BR IF SO
000064 8902                ORI    FLAGS,STACK          SET STACK BIT
000065 5122       STOPLINK XFR    LINK2,IC             XFR LINK TO IC
000066 62C9       NOSTACK  BU     TERMSTK1             GO RESET CHAN TAGS
                  ************************************************************************
                  *THE TAKELINK ROUTINE IS ENTERED BY SERVICE OUT RESPONSE TO STATUS IN.*
                  *THE CHAIN, STACK, AND STATUS PENDING FLAGS ARE MANIPULATED AND CUE   *
                  *FOR SELECTED CHANNEL IS RESET. THE ALLOW DATA SECURITY ERASE FLAG    *
                  *IS ALSO MAINTAINED HERE DEPENDENT UPON CHAINING. RETURN IS VIA       *
                  *LINK1                                                                *
                  ************************************************************************

000067 4150       TAKEDISC XFR    CTIMAGE,CTI          RESET OP IN RAISE CUB
000068 606A                BU     SKIPSUPO              SKIP CHAINING CHECK

000069 3971       TAKELINK BOC    SUPO,SETCHAIN        CHAIN INDICATION
00006A C9F0       SKIPSUPO AND    FLAGS,CUEA+CUEB+INTFB+CONCON RESET CHAIN,STATUS PENDING
                  *                                    AND STACK FLAGS
00006B CAEF                AND    FLAGS1,ONES-ALLOWDSE RESET ALLOW DAT SEC ERS FLAG

00006C D520       TAKELIN1 ANDM   PNDSTS,CUE           DID WE PRESENT CONTROL UNIT END
00006D 2070                BOC    DBUS,SERVLINK        BRANCH IF NOT

                  *** A CUE WAS PRESENTED--DETERMINE THE SELECTING CHANNEL AND RESET
                  *** THE CORRESPONDING CUE FLAG                                       ***
00006E 2313                BOC    MIFTR,MIFTR01        BRANCH IF MIS AVAILABLE
00006F C9BF       RSTCUEA  AND    FLAGS,ONES-CUEA      RESET CUE A FLAG

000070 5022       SERVLINK XFR    LINK1,IC             XFR LINK TO IC
```

```
000071 8901       1504 SETCHAIN ORI    FLAGS,CHAIN            SET CHAIN FLAG
000072 8120       1507          ORI    CTIMAGE,HOLDINT        RAISE HOLD INTERFACE BIT
000073 F017       1510          XOM    CURCOMM,X'17'          IS LAST COMMAND ERASE'
000074 2078       1513          BOC    DBUS,ENABLDSE          BRANCH IF SO
000075 CAEF       1516          AND    FLAGS1,ONES-ALLOWDSE   RESET DSE BIT
000076 C9F1       1519 SKIPIT   AND FLAGS,CHAIN+CUEB+CUEA+INTFB+CONCON RESET OTHER FLAGS
000077 606C        522          BU     TAKELIN1

000078 8A10       1526 ENABLDSE ORI :  FLAGS1,ALLOWDSE        SET THE ALLOW DSE BIT
000079 6076       1529          BU     SKIPIT                 RETURN


                  1533 *****************************************************************
                  1534 * HIO LINK IS ENTERED IF ADDRESS OUT IS UP OR RISE WHILE THE STATRTN *
                  1535 * ISBEING EXECUTED. RETURN IS VIA LINK 3 WHICH IS SET UP BY THE      *
                  1536 * STATRTN CALLER                                                    *
                  1537 *****************************************************************


00007A 5222       1540 HIOLINK  XFR    LINK3,IC               GO HANDLE HIO


00007B E111       1544 HIOLINK1 XO     CTIMAGE,OPIN+CUBUSY RESET OP IN RAISE CUB
00007C 2D67       1547          BOC     SVCOUT,TAKEDISC       BRANCH IF STATUS ACCEPTED
00007D 295A       1550          BOC    CMDOUT,STAKDISC        BRANCH IF STATUS REJECTED
00007E 607A       1553          BU     HIOLINK                 OTHERWISE GO TO HIO NOT OPERATING

                  1556 ************************************* SIO ROUTINE *****************
                  1557 * THE START IO ROUTINE CHECKS FOR SHORT BUSY CONDITIONS. IF NONE FOUND*
                  1558 * IT BRANCHES TO THE NO SHORT ROUTINE TO ANSWER THE SIO.            *
                  1559 *****************************************************************


00007F 43A0       1562 SIORTN   XFR    CURADDR,CBO            FETCH CURRENT ADDRESS
000080 44A0       1565          XFR    WORK1,CBO              ADDRESS TO SCRATCH AREA
000081 12AD       1568          STO    LINK3,PRETURNO         SET HIO LINK FOR NOT OPERATING
000082 5441       1571          XFR    XOUTBIM,XOUTB          TRAP ALU2 TO LOC 0
000083 D986       1574          ANDM   FLAGS,STATPNDG+STACK+CONCON MASK FOR PENDING OR STACKED
                  1576 *                                      STATUS AND CONTINGENT CONN. FLAGS
000084 208F       1578          BOC    DBUS,NOSHORT           BRANCH IF ALL ARE OFF
000085 3588       1581          BOC    DREG5,NOTCONT          BRANCH IF STACK
000086 3688       1584          BOC    DREG6,NOTCONT          BRANCH IF STATUS PENDING
000087 0500       1587          STO    PNDSTS,0               CONT CONN--CLEAR THE STAUS REG
000088 4621       1590 NOTCONT  XFR    PNDADDR,AR             MOVE PEND ADDRESS TO AREG
000089 E400       1593          XOM    WORK1,0                TEST FOR MATCH
00008A 208F       1596          BOC    DBUS,NOSHORT           BRANCH IF MATCH


                  1598 *****************************************************************
                  1599 *THE SHORTBUSY ROUTINE USES THE UPROGRAM TO MANIPULATE  BUS IN AND  *
                  1600 *TAGS IN FOR A SHORT BUSY SEQUENCE. CUE IS SET IN THE STATUS.       *
                  1601 *****************************************************************
00008B 8110       1603 SHORTBSY ORI    CTIMAGE,CUBUSY         SET UP CUB BIT IN CTI IMAGE REG
00008C 4150       1606          XFR    CTIMAGE,CTI            MOVE TO CHANNEL TAG IN REG
00008D 8520       1609          ORI    PNDSTS,CUE             POST CUE WITH STATUS
00008E 629E       1612          BU     TERMSTA2               GO RESET CUE LATCH FOR SELECTING
                  1614 *                                      INTERFACE


                  1616 *****************************************************************
                  1617 *THE NOSHORT RTN ANSWERS ADDRESS OUT AND INITIALIZES ALU 2 TO ASSEMBLE*
                  1618 *TU STATUS. VARIOUS FLAGS AND REGISTERS ARE INITIALIZED AND A CHECK  *
                  1619 *IS MADE TO SEE IF A HIO WAS RECEIVED BY HARDWARE AFTER OP-IN WAS    *
                  1620 *RAISED.                                                            *
                  1621 *****************************************************************


00008F 8101       1624 NOSHORT  ORI    CTIMAGE,OPIN           MASK OP IN UP
000090 4150       1627          XFR    CTIMAGE,CTI            RAISE OP IN
000091 0800       1630          STO    STATIMG,0              CLEAR THE STATIMAGE REG
000092 0600       1633          STO    PNDADDR,0              CLEAR CURRENT ADDRESS REG FOR MASK
000093 4321       1636          XFR    CURADDR,AR             XFR SELECT  ADDRESS TO ALU INPUT REG
000094 8600       1639          ORI    PNDADDR,0              MOVE ADDRESS TO PNDG ADDRESS REG
000095 C40F       1642 STRIPADD AND    WORK1,X'0F'            STRIP HIGH ORDER
000096 4442       1645          XFR    WORK1,XOUTA            GIVE ALU 2 ADDRESS

                  1648 *** DETERMINE WHICH CHANNEL IS SELECTING AND INITIALIZE THE STAT REG,
                  1649 *** TU ADDRESS REG AND FLAGS REG.
000097 231E       1651          BOC    MIFTR,MIFTR03          BRANCH IF MIS AVAILABLE          ***
000098 C9DF       1654 SETSWSEL AND    FLAGS,ONES-INTFB       RESET B FLAG
000099 D946       1657          ANDM   FLAGS,STATPNDG+STACK+CUEA  ANY STATUS BEING HELD
00009A 209D       1660 CHKPNDG  BOC    DBUS,SETADDR           BRANCH IF NONE PENDING
00009B 359E       1663          BOC    DREG5,STRTALU2         BRANCH IF STATUS PENDING
00009C 8802       1666          ORI    STATIMG,SETSTATC       SET SHORT INIT SEL TO ALU2

00009D 14ED       1670 SETADDR  STO    XOUTBIM,NDXSTS             FETCH ALU2'S STATUS RTN INDEX
00009E 4828       1673 STRTALU2 XFR    STATIMG,STAT           SET STATS TO HDWE
00009F 4424       1676          XFR    WORK1,TUADR            SET ADDRESS REG
0000A0 5441       1679          XFR    XOUTBIM,XOUTB          TRAP ALU 2
0000A1 8102       1682          ORI    CTIMAGE,ADDIN          MASKADDRESS IN UP
0000A2 4360       1685          XFR    CURADDR,CBI            RAISE ADDRESS ON BUS IN

0000A3 28AC       1689 ADROUTUP BOC    ADROUT,SELOUTUP        WAIT FOR ADRESS OUT FALL
0000A4 4150       1692 SETADRIN XFR    CTIMAGE,CTI            RAISE ADDR IN
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                  1695 ********************************************************************
                  1696 *ASSEMBLE DATA FLOW MASK WHILE SYSTEM BRINGS UP CMD OUT.            *
                  1697 ********************************************************************

0000A5 D901       1700 MASEMBLE ANDM  FLAGS,CHAIN         SET UP FLAGS FOR TEST
0000A6 20AE       1703          BOC   DBUS,RSTDIAG        IS CHAIN FLAG ON?
0000A7 DC80       1706          ANDM  SETDIA1,DIAWRT      MASK TO TEST DIAG WRT BIT
0000A8 20AF       1709          BOC   DBUS,CHKFTR         BRANCH IF DIAG MODE OFF
0000A9 8810       1712          ORI   STATIMG,DIAGMODE    SET DIAG MODE BIT IN STAT REG
0000AA 482B       1715          XFR   STATIMG,STAT        SET STATS TO HDWF
0000AB 60AF       1718          BU    CHKFTR              GO CHECK NRZI

0000AC 26A3       1722 SELOUTUP BOC   SELO,ADROUTUP       BRANCH IF OP IN STILL
0000AD 634B       1725 PRETURNO BU    HIONOP              GO TO HIO NOT OPERATING

0000AE CC00       1729 RSTDIAG  AND   SETDIA1,0           RESET DIAG MODE BITS

0000AF 23C0       1733 CHKFTR   BOC   MIFTR,SETSEV        BRANCH IF SEVEN TK FEAT   ***

0000B0 DA40       1737 CHKNRZ   ANDM  REQTAGS,ANRZI       CHECK FOR NRZI FLAG
0000B1 20B3       1740          BOC   DBUS,CMDWAIT        BRANCH IF NRZI BIT OFF
0000B2 8201       1743          ORI   XOUTAIM,NRZMODE     SET XOUTA IMAGE NRZ BIT

                  1746 ********************************************************************
                  1747 * WAIT FOR AND PROCESS COMMAND OUT. DETERMINE WHETHER OPERATION     *
                  1748 * CAN PROCEED.                                                      *
                  1749 ********************************************************************

0000B3 28AD       1753 CMDWAIT  BOC   ADROUT,PRETURNO     HALT IO NOT OPERATING
0000B4 29B6       1756          BOC   CMDOUT,CMDWAIT1     FIRST COMMAND OUT
0000B5 60B3       1759          BU    CMDWAIT             WAIT

0000B6 C1FD       1763 CMDWAIT1 AND   CTIMAGE,ONES-ADDIN  MASK ADDR IN DOWN
0000B7 40A0       1766          XFR   CURCOMM,CBO         MOVE COMMAND TO LSR
0000B8 24C2       1769          BOC   BQPE,CMDPARER       BRANCH IF CMD PAR ERR
                  1772 *** IF MIS AVAILABLE GO CHECK TO SEE IF CONTINGENT CONNECTION FLAG
                  1773 *** IS TO BE RESET
0000B9 2320       1775          BOC   MIFTR,MIFTR04       BRANCH IF MIS AVAILABLE
0000BA 4150       1778 CMDWAIT4 XFR   CTIMAGE,CTI         DROP ADDRESS IN
0000BB D904       1781          ANDM  FLAGS;STATPNDG        STATUS PNDING
0000BC 20C1       1784          BOC   DBUS,CMDPROC        NO, GO TO CMD PROCESS

0000BD 9000       1788 CMDWAIT3 ORM   CURCOMM,ZERO        IS IT TEST IO
0000BE 20C0       1791          BOC   DBUS,PENDLINK       IF YES SEND STATUS
0000BF 8510       1794          ORI   PNDSTS,BUSY         IF NO POST BUSY
0000C0 6299       1797 PENDLINK BU    TERMSTAT            GO TO RAISE STATUS IN

0000C1 6100       1801 CMDPROC  BU    COMDECOD            GO DECODE THE CMD

                  1804 ********************************************************************
                  1805 *THE COMPARER HANDLES BUS OUT CHECKS DURING COMMAND TRANSFER.        *
                  1806 ********************************************************************
0000C2 8720       1808 CMDPARER ORI   SNSSTS2,BUSOC       POST BUS OUT CHECK
0000C3 D906       1811 CMDPARO  ANDM  FLAGS,STATPNDG+STACK TEST FOR STATUS PENDING OR STACK
0000C4 20C7       1814          BOC   DBUS,CMDPAR1        BRANCH IF NO
0000C5 8510       1817          ORI   PNDSTS,BUSY         POST BUSY IN STATUS
0000C6 60BA       1820          BU    CMDWAIT4            GO TO STORE LINKS

0000C7 0502       1824 CMDPAR1  STO   PNDSTS,UNITCHK      POST A UNIT CHECK
0000C8 8904       1827          ORI   FLAGS,STATPNDG      POST STATUS PNDG FLAG
0000C9 CB7F       1830          AND   FLAGS2,ONES-FORCFUC  RESET FORCE UNIT CHECK FLAG
0000CA 140B       1833          STO   XOUTBIM,NDXABRT-ALU2BRT  LOAD ALU2 INIT ADDRESS
0000CB 5441       1836          XFR   XOUTBIM,XOUTB       TRAP ALU2 TO PREVENT DE RESET
0000CC 4150       1839          XFR   CTIMAGE,CTI         DROP ADDRESS-IN
0000CD 6299       1842          BU    TERMSTAT            GO TO STORE LINKS
                  1846 ************************************ OPENERS *************************
                  1847 *  OPENERS WILL RESET THE PING HOLD LATCH IN HARDWARE IF THE COMMAND  *
                  1848 * IS OTHER THAN TIO AND THE STATUS STACKED OR PENDING FLAGS ARE OFF.  *
                  1849 * WHEN ALU2 COMPLETES ASSEMBLING THE DEVICE STATUS, THIS ROUTINE WILL *
                  1850 * CHECK ALU2 STATS TO DETERMINE IF THE DEVICE IS BUSY,NOT READY,OR HAS*
                  1851 *A PENDING DEV END. IF NONE OF THE AFOREMENTIONED ITEMS APPLY THEN THE*
                  1852 *DEVICE IS AVAILABLE AND THE COMMAND WILL BE DECODED. ALU2 STAT COMBOS*
                  1853 *HAVE THE FOLLOWING MEANING:                                         *
                  1854 *        STATC=DEV END,UNT CHK(READY DROP WHEN DEV END WAS PRIMED)    *
                  1855 *        STATB AND STATC=DEV END DUE TO DEV END PRIME(REW OR DSE)     *
                  1856 *        STATB AND STATD=DEVICE IS BUSY                               *
                  1857 *        STATC AND STATD=DEVICE IS NOT READY                          *
                  1858 *                                                                    *
                  1859 ********************************************************************

0000CE 63E3       1862 RTNCOMR  BU    COMREJC1            RETURN TO COMMAND REJECT
0000CF 617F       1865 RTNSENS  BU    SENSEOK             RETURN TO SENSE
0000D0 621F       1868 RTNPROT  BU    PROTEST1            RETURN TO CHECK FILE LPROTECT
0000D1 622B       1871 RTNTUTST BU    TUTESTIT            RETURN TO CHECK READY
0000D2 622F       1874 RTNTUTS1 BU    TUTEST2             RETURN TO DO SENSE RESET

0000D3 2317       1878 OPENERS  BOC   MIFTR,MIFTR02       BRANCH IF MIS AVAILABLE

0000D4 3BE1       1882 OPENERS1 BOC   STATD,ANYERRS       IF ALU2 FINISHED,GO LOOK FOR ERROR
0000D5 2BEE       1885          BOC   STATB,CHKBUSY       IF ON GO CHECK FOR PENDING DEV END
0000D6 3AD9       1888          BOC   STATC,SEEIFUC       BRANCH IF ON TO CHECK FOR DE, UC STS
0000D7 28AD       1891          BOC   ADROUT,PRETURNO     HALT IO?
0000D8 60D4       1894          BU    OPENERS1            ALU2 STILL BUSY, GO BACK
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                 1898 *** STAT C WAS ON
0000D9 3BE1      1900 SEEIFUC  BOC   STATD,ANYERRS        BRANCH IF INT REQ
0000DA 2BF2      1903          BOC   STATB,CONTCHK1       BRANCH IF DEV END
0000DB D902      1906          ANDM  FLAGS,STACK          MASK FOR STACK LAG
0000DC 20DF      1909          BOC   DBUS,SETDEUC         BRANCH IF OFF
0000DD 8506      1912          ORI   PNDSTS,DEVEND+UNITCHK  OTHERWISE OR IN DE AND UC
0000DE 60BD      1915          BU    CMDWAIT3             GO CHECK FOR TIO
0000DF 0506      1918 SETDEUC  STO   PNDSTS,DEVEND+UNITCHK SET UC,DE--READY DROP ON DEP DEV
0000E0 60BD      1921          BU    CMDWAIT3

                 1924 *** STAT D WAS ON
0000E1 22C3      1926 ANYERRS  BOC   ALUR,CMDPAR0         BRANCH IF ANY ALU ERROR
0000E2 2BFF      1929          BOC   STATB,BUSYSTAT       BRANCH IF BUSY CONDITION
0000E3 D90       1932          ANDM  FLAGS,STACK          MASK FOR STACK FLAG
0000E4 20E6      1935          BOC   DBUS,CONTCHK         BRANCH IF OFF TO CONTINUE
0000E5 60BD      1938          BU    CMDWAIT3             GO PRESENT STACKED STATUS

                 1941 *** STAT B OFF--STATD ON---STATC EITHER
0000E6 0500      1943 CONTCHK  STO   PNDSTS,0             CLEAR PENDING STATUS REG
0000E7 4488      1946          XFR   WORK1,XINB           GET TU SENSE BYTE 0
0000E8 D950      1949          ANDM  FLAGS,CUEA+CUEB      MASK FOR CUE FLAGS
0000E9 2389      1952          BOC   MIFTR,MIFTR14        BRANCH IF MIS AVAILABLE
0000EA 31BD      1955 CUEASTS  BOC   DREG1,CMDWAIT3       BRANCH IF CUE ON A INTF

0000EB C8FD      1958 TUTSTRTN AND   STATIMG,ONES-SETSTATC RESET STAT C IN IMAGE REG
0000EC 4828      1961          XFR   STATIMG,STAT         SET TO HARDWARE
0000ED 5322      1964          XFR   LINK4,IC             RETURN TO TEST TAPE UNIT

                 1967 *** STAT B ON
0000EE 3BE1      1969 CHKBUSY  BOC   STATD,ANYERRS        IF ON MUST HAVE BEEN NORMAL END
0000EF 3AF2      1972 LOOKAGIN BOC   STATC,CONTCHK1       BRANCH IF DEV SELECTED
0000F0 3BF8      1975          BOC   STATD,BUSYSTAT       BRANCH IF DEV SWITCHED
0000F1 60EF      1978          BU    LOOKAGIN             GO LOOK AGAIN

                 1981 *** STATS B AND C ON--STAT D OFF
0000F2 D902      1983 CONTCHK1 ANDM  FLAGS,STACK          MASK FOR STACK FLAG
0000F3 20F6      1986          BOC   DBUS,CONTCHK2        BRANCH IF OFF TO CONTINUE
0000F4 8504      1989          ORI   PNDSTS,DEVEND        OR IN DEV END IN STATUS
0000F5 60BD      1992          BU    CMDWAIT3             GO PRESENT STACKED STATUS

                 1995 *** NO STACKED STATUS
0000F6 0504      1997 CONTCHK2 STO   PNDSTS,DEVEND        SET DEV END IN PENDING STATUS
0000F7 60BD      2000          BU    CMDWAIT3             GO SET LINKS


0000F8 0510      2004 BUSYSTAT STO   PNDSTS,BUSY          BUSY IN SCRATCH REG
0000F9 60C0      2007          BU    PENDLINK             GO TO RAISE STATUS IN
000100           2012          ORG   BEGIN+X'100'
                 2013 ********************************** COMMAND DECODE ****************
                 2014 * THE COMMAND WILL BE DECODED IF THEIR IS NO STATUS PENDING OR      *
                 2015 * STACKED. EACH COMMAND(EXCEPT MODE TYPE) WILL BE CHECKED FOR       *
                 2016 * DISCRETE CODES AND COMMAND REJECTED IF NOT RECOGNIZED.            *
                 2017 ********************************************************************

000100 9000      2020 COMDECOD ORM   CURCOMM,0            MASK COMMAND CODE FOR TESTING
000101 3718      2023          BOC   DREG7,IS6ON          BRANCH IF BIT 7 ON TO CHK BIT 6
000102 3638      2026          BOC   DREG6,READTYPE       BRANCH IF BIT 6 ON (READ CMD)
000103 353A      2029          BOC   DREG5,CHKRDB         BRANCH IF BIT 5 ON
000104 2040      2032          BOC   DBUS,DOTESTIO        CHECK FOR TEST I/O
000105 6108      2035          BU    COMREJCT             GO REJECT COMMAND


                 2039 ********************************************************************
                 2040 *COMMAND MUST BE CONTROL SINCE BITS 5,6,AND 7 ARE PRESENT.          *
                 2041 ********************************************************************

000106 F097      2044 CKDSE    XOM   CURCOMM,X'97'        MASK FOR DATA SECURITY ERASE CMD
000107 2023      2047          BOC   DBUS,DODSE           BRANCH IF IT IS

                 2050 ***************************** COMMAND REJECT *************************
                 2051 * COMMAND REJECT WILL BE BRANCHED INTO BY SEVERAL COMMAND DECODE    *
                 2052 * ROUTINES. SENSE DATA WILL BE CLEARED AND COMMAND REJECT WILL BE   *
                 2053 * POSTED IN SENSE BYTE 0                                            *
                 2054 ********************************************************************

000108 13CE      2057 COMREJCT STO   LINK4,RTNCOMR        SET OPENERS RETURN
000109 60D3      2060          BU    OPENERS              GO CHECK DEV STATUS


00010A 3006      2064 CONTCMD  BOC   DREG0,CKDSE          BRANCH IF HI ORDER BIT IS ON
00010B 3108      2067          BOC   DREG1,COMREJCT       COMMAND REJECT IF BIT 1 IS ON

00010C 3414      2071          BOC   DREG4,COMTESTA       BRANCH IF CMD IS 00XX1111
00010D 3320      2074          BOC   DREG3,COMTESTB       BRANCH IF CMD IS 00X10111
00010E 322E      2077          BOC   DREG2,DOBKSPBL       IF 1, MUST BE BACKSPACE BLOCK


                 2080 ********************************************************************
                 2081 *REWIND IS DECODED AT THIS POINT. CAN WE PERFORM IT? MAKE TESTS     *
                 2082 ********************************************************************

00010F 142F      2085 DOREWIND STO   XOUTBIM,NDXRWD           EMIT ALU2 BRANCH ADDRESS ***
000110 8808      2088          ORI   STATIMG,SETSTATA     SET RWD INDICATOR FOR CONTEND
000111 4828      2091          XFR   STATIMG,STAT         SET STATA IN HDWE
000112 1033      2094 DORWD1   STO   LINK1,CONTINIT       LINK TO CONTROL INIT STATUS
000113 6227      2097          BU    TUTEST               GO TO TU STATUS TEST
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000114 3329       2101 COMTESTA BOC   DREG3,COMTESTC         BRANCH IF CMD IS 00X11111
000115 3232       2104          BOC   DREG2,DOBAKFIL         IF=1, MUST BE BACKSPACE FILE

                  2107 * COMMAND IS 00001111 OR REWIND UNLOAD
000116 1429       2109 DORUNLOD STO   XOUTBIM,NDXRWU               EMIT ALU2 BRANCH ADDRESS ***
000117 6112       2112          BU    DORWD1


000118 364A       2116 IS6ON    BOC   DREG6,IS5ON
000119 F001       2119 WRTCHECK XOM   CURCOMM,X'01           CHECK FOR DISCRETE CMD
00011A 201C       2122          BOC   DBUS,ITSOK             BRANCH IF IT IS
00011B 6108       2125          BU    COMREJCT               OTHERWISE REJECT COMMAND

00011C 8240       2129 ITSOK    ORI   XOUTAIM,WRITE          ADD WRITE TO DATA FLOW MASK
00011D 1413       2132          STO   XOUTBIM,NDXWRT           EMIT ALU2 BRANCH ADDRESS ***
00011E 1070       2135          STO   LINK1,CLEANIT          LINK TO CLEAN INITIAL STAUTS RTN
00011F 621D       2138          BU    PROTEST

000120 3234       2142 COMTESTB BOC   DREG2,DOFORBLK         IF 1 MUST BE FORWARD SPACE BLOCK
                  2144 * COMMAND IS 00010111 OR ERASE GAP
000121 1422       2146 DOERG    STO   XOUTBIM,NDXERG               EMIT ALU2 BRANCH ADDRESS ***
000122 612B       2149          BU    DOWTM1

000123 DA10       2153 DODSE    ANDM  FLAGS1,ALLOWDSE        MASK TO TEST ALLOW DSE FLAG BIT
000124 2008       2156          BOC   DBUS,COMREJCT          BRANCH IF OFF TO CMD REJECT
000125 1431       2159          STO   XOUTBIM,NDXERS            EMIT ALU2 BRANCH ADDRESS ***
000126 8808       2162          ORI   STATIMG,SETSTATA       SET DSE INDICATOR FOR CONTEND
000127 4828       2165          XFR   STATIMG,STAT           SET TO HDWE
000128 612B       2168          BU    DOWTM1                 GO SET DF MASK

000129 3236       2172 COMTESTC BOC   DREG2,DOFORFIL         IF 1,  MUST BE FSF


                  2175 * COMMAND IS 00011111 OR WRITE TAPE MARK
00012A 1420       2177 DOWTM    STO   XOUTBIM,NDXWTM               EMIT ALU2 BRANCH ADDRESS ***
00012B 82C0       2180 DOWTM1   ORI   XOUTAIM,WRITE+CONTROL ADD WRITE AND CONTROL TO DF MASK
00012C 1033       2183          STO   LINK1,CONTINIT         LINK TO CONTROL INITIAL STATUS
00012D 621D       2186          BU    PROTEST                GO TO TEST FILE PROTECT


                  2189 * COMMAND IS 00100111 OR BACKSPACE RECORD
00012E 143E       2191 DOBKSPBL STO   XOUTBIM,NDXBSR               EMIT ALU2 BRANCH ADDRESS ***
00012F 8280       2194 DOCONTRL ORI   XOUTAIM,CONTROL        SET CONTROL BIT IN DATA FLOW MASK
000130 1033       2197          STO   LINK1,CONTINIT         SET RETURN TO CONTROL COMMANDS
000131 6144       2200          BU    DOREAD2                GO SET READ BACK MASK BIT

                  2203 * COMMAND IS 00101111 OR BACKSPACE FILE
000132 143C       2205 DOBAKFIL STO   XOUTBIM,NDXBSF               EMIT ALU2 BRANCH ADDRESS ***
000133 612F       2208          BU    DOCONTRL               GO SET DF MASK BITS

                  2211 * COMMAND IS 00110111 OR FORWARD SPACE RECORD
000134 1437       2213 DOFORBLK STO   XOUTBIM,NDXFSR               EMIT ALU2 BRANCH ADDRESS ***
000135 612F       2216          BU    DOCONTRL               GO SET DF CONTROL BIT

                  2219 * COMMAND IS 00111111 OR FORWARD SPACE FILE
000136 1435       2221 DOFORFIL STO   XOUTBIM,NDXFSF               EMIT ALU2 BRANCH ADDRESS ***
000137 612F       2224          BU    DOCONTRL               GO SET DF CONTROL BIT


                  2227 ***********************************************************************
                  2228 *SEPARATE READ TYPE COMMANDS BY FURTHER DECODING                      *
                  2229 ***********************************************************************
000138 F002       2231 READTYPE XOM   CURCOMM,X'02'          TEST FOR READ CODE
000139 2042       2234          BOC   DBUS,DOREAD            BRANCH IF READ
00013A F00C       2237 CHKRDB   XOM   CURCOMM,X'0C'          TEST FOR READ BACKWARD
00013B 2046       2240          BOC   DBUS,DORDBACK          BRANCH IF READ BACKWARD
00013C F004       2243          XOM   CURCOMM,X'04'          TEST FOR SENSE CODE
00013D 207D       2246          BOC   DBUS,DOSENSE           BRANCH IF SENSE
00013E 232C       2249          BOC   MIFTR,CHKRSRV          BRANCH IF MIS AVAILABLE          ***
                  2251 * IF COMMAND OP CODE WAS NONE OF THE ABOVE, IT IS INVALID AND WILL
                  2252 * BE REJECTED
00013F 6108       2254          BU    COMREJCT               GO REJECT COMMAND

000140 1099       2258 DOTESTIO STO   LINK1,TERMSTAT         EMIT LINK TO TERMINAL STATUS RTN
000141 6229       2261          BU    TUTEST1                TEST TU STATUS


000142 1433       2265 DOREAD   STO   XOUTBIM,NDXRDF               EMIT ALU2 BRANCH ADDRESS ***
000143 1070       2268 DOREAD1  STO   LINK1,CLEANIT          LINK TO CLEAN INITIAL ROUTINE
000144 8208       2271 DOREAD2  ORI   XOUTAIM,RDRDB          ADD RD OR RDB BIT TO DF MASK
000145 6227       2274          BU    TUTEST                 GO TO TEST TU STATUS


000146 143A       2278 DORDBACK STO   XOUTBIM,NDXRDB               EMIT ALU2 BRANCH ADDRESS ***
000147 C2DF       2281          AND   XOUTAIM,ONES-DATCON    RESET DATA CONVERT IF SEV TRK
000148 6143       2284          BU    DOREAD1                GO TO READ INITIALIZE
                  2287 ******************************* MODE COMMAND DECODE ****************
                  2288 * DECODE MODETYPE COMMANDS FURTHER AND PERFORM FUNCTION REQUIRED.     *
                  2289 * SET CHANNEL END-DEVICE END IN INITIAL STATUS. REQ TIE AND SET      *
                  2290 * DIAGNOSE COMMANDS WILL LINK TO THE WRITE ROUTINE TO FETCH THE FIRST *
                  2291 * BYTE OF DATA. THE 7 TRK FEATURE WILL BE CHECKED TO SEE IF IT IS    *
                  2292 * PRESENT. ALL MODE TYPE COMMAND ARE VALID. ANY NOT SPECIFICALLY     *
                  2293 * RECOGNIZED TO PERFORM A FUNCTION WILL BE TREATED AS SENSE RESET   *
                  2294 * NO-OPS.                                                            *
                  2295 ***********************************************************************
                  2296 ***********************************************************************
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000149 6578     2299 GOSETDIA BU    DOSETDIA            GO EXECUTE SET DIAGNOSE CMD

00014A 350A     2303 IS5ON    BOC   DREG5,CONTCMD
00014B 3155     2306 MODETYPE BOC   DREG1,CKHIMODE      BRANCH TO CHECK HI MODES(X1XXX011)
00014C F00B     2309          XOM   CURCOMM,X'0B'       MASK FOR DIAGNOSTIC MODE SET
00014D 2066     2312          BOC   DBUS,DODIAMS        BRANCH IF YES
00014E F01B     2315          XOM   CURCOMM,X'1B'       MASK FOR TRACK IN ERROR MODE SET
00014F 206A     2318          BOC   DBUS,DOTIEMS        BRANCH IF IT IS
000150 F003     2321          XOM   CURCOMM,X'03'       MASK FOR NO-OP COMMAND
000151 205D     2324          BOC   DBUS,ISNOOP         BRANCH IF IT IS
000152 F08B     2327          XOM   CURCOMM,X'8B'       MASK FOR LWR COMMAND
000153 2068     2330          BOC   DBUS,DOLWR          BRANCH IF IT IS
000154 615B     2333          BU    ANY7TK              BRANCH TO CHECK 7 TRACK
000155 F0CB     2337 CKHIMODE XOM   CURCOMM,X'CB'       MASK FOR NRZI MODE SET
000156 2063     2340          BOC   DBUS,DONRZMS        BRANCH IF IT IS
000157 F0C3     2343          XOM   CURCOMM,X'C3'       MASK FOR PE MODE SET
000158 205F     2346          BOC   DBUS,DOPEMS         BRANCH IF IT IS
000159 F04B     2349          XOM   CURCOMM,X'4B'       MASK FOR SET DIAGNOSE CMD
00015A 206A     2352          BOC   DBUS,DOTIEMS        BRANCH IF IT IS
00015B 2395     2355 ANY7TK   BOC   MIFTR,CHK7TK        BRANCH IF SEVEN TRACK AVAILABLE
00015C 6161     2358          BU    MODELINK            GO SET TUTEST RETURN

00015D 101B     2362 ISNOOP   STO   LINK1,TRETURN3      SET NO-OP RETURN
00015E 6229     2365          BU    TUTEST1             GO CHECK TU STATUS

00015F 238D     2369 DOPEMS   BOC   MIFTR,MIFTR15       BRANCH IF MIS AVAILABLE
000160 CABF     2372 DOPEA    AND   FLAGS1,ONES-ANRZI   RESET THE NRZI FLAG FOR INTF A
000161 1019     2375 MODELINK STO   LINK1,TRETURN2      SET TU TEST ROUTINE RETURN
000162 6227     2378          BU    TUTEST              GO TO TEST THE DEV

000163 2391     2382 DONRZMS  BOC   MIFTR,MIFTR16       BRANCH IF MIS AVAILABLE
000164 8A40     2385 DONRZA   ORI   FLAGS1,ANRZI        SET NRZI MODE FLAG  FOR INTF A
000165 6161     2388          BU    MODELINK            GO SET RETURN

000166 8C80     2392 DODIAMS  ORI   SETDIA1,DIAWRT      SET THE DIAG MODE FLAG
000167 6161     2395          BU    MODELINK            GO SET RETURN

000168 8C04     2399 DOLWR    ORI   SETDIA1,LWROP       SET LOOP WRITE TO READ FLAG
000169 611C     2402          BU    ITSOK               RETURN TO WRITE ROUTINE

00016A 1070     2406 DOTIEMS  STO   LINK1,CLEANIT       SET TU TEST ROUTINE RETURN
00016B 6227     2409          BU    TUTEST              GO TEST DRIVE STATUS

00016C F04B     2413 DOTIEMS1 XOM   CURCOMM,X'4B'       MASK FORSET DIAGNOSE CMD
00016D 2049     2416          BOC   DBUS,GOSETDIA       BRANCH IF IT IS
00016E 42A0     2419          XFR   XOUTAIM,CBO         FETCH TIE BYTE
00016F 4150     2422          XFR   CTIMAGE,CTI     RESET SERVICE IN
                2424 *** SCREEN TIE BYTE FOR SINGLE TRACK ERROR. MOVE BYTE TO DATA FLOW
                2425 *** DEAD TRACK REG ONLY IF IT WAS SINGLE TRACK.
000170 9200     2427          ORM   XOUTAIM,0           MASK FOR TESTING
000171 207A     2430          BOC   DBUS,DOTIEMS2       BRANCH IF 0--CORRECT FOR TRK P
000172 0401     2433          STO   WORK1,1             INITIALIZE WORK1 TO RIPPLE SINGLEBIT

000173 4421     2437 NOTLAST  XFR   WORK1,AR            SET GENERATED SINGLE BIT IN A REG
000174 F200     2440          XOM   XOUTAIM,0           MASK FOR MATCHING BYTES
000175 207A     2443          BOC   DBUS,DOTIEMS2       BRANCH IF MATCH TIE BYTE ONLY HAS
                2445 *                                  A SINGLE BIT ON
000176 4421     2447 DOAGAIN  XFR   WORK1,AR            XFR PATTERN BIT TO ALU INPUT REG
000177 A400     2450          ADD   WORK1,0             SHIFT PATTERN BIT RIGHT ONE TIME
000178 2173     2453          BOC   NALCO,NOTLAST       BRANCH IF NOT LAST PATTERN
000179 63D6     2456          BU    CHEKSNS             OTHERWISE, NO MATCH FOUND GET OUT

00017A 4242     2460 DOTIEMS2 XFR   XOUTAIM,XOUTA       SET TIE BYTE IN DATA FLOW REG
00017B 4014     2463          XFR   TIP                 TRANSFER TO DEAD TRACK REG
00017C 63D6     2466          BU    CHEKSNS             GO SET UP ENDING STATUS

                2470 ****************************** SENSE OP *********************************
                2471 *THIS ROUTINE CONTROLS THE SENSE OPERATION.                               *
                2472 *THE SENSE BYTES WHICH ARE ASSEMBLED BY ALU2 ARE PASSED VIA THE XOVER *
                2473 *REGISTERS . WHEN A BYTE OF SENSE INFO DOES NOT APPLY THEN THE XOVER  *
                2474 *WILL CONTAIN ZEROS. SENSE BYTES 2, 3, 4 13, 14, AND 17 ARE GATED BY  *
                2475 *BITS SET IN ALU1 XOVER REG XOUTA AND THE SENSE STAT TURNED ON.        *
                2476 ***********************************************************************

00017D 13CF     2479 DOSENSE  STO LINK4,RTNSENS         SET OPENERS RETURN
00017E 60D3     2482          BU    OPENERS             GO CHECK DEVICE STATUS

00017F 0500     2486 SENSEOK  STO   PNDSTS,ZERO         CLEAR REG OF OLD STATUS
000180 104A     2489          STO   LINK1,SRETURN2      RETURN TO SENSE0
000181 1156     2492          STO   LINK2,WATESUM       SET UP IN CASE OF INTERFACE ERR
000182 604E     2495          BU    STATRTN             GO PRESENT STATUS

000183 4150     2499 SENSE0   XFR   CTIMAGE,CTI         DROP STATUS IN
000184 14E1     2502          STO   XOUTBIM,NDXSNS          LOAD INDEX FOR ALU2  ***
000185 5441     2505          XFR   XOUTBIM,XOUTB       START ALU2 OFF
000186 1388     2508          STO   LINK4,SENSE1        RETURN TO SENSE1
000187 61E2     2511          BU    PULL2               GO GET 1ST 2 BYTES

                2514 *  SENSE BYTES 0 AND 1

000188 04FE     2517 SENSE1   STO   WORK1,X'FE'         TRANSFER
000189 4721     2520          XFR   SNSSTS2,AR          SENSE STATUS 2 TO
00018A C400     2523          AND   WORK1,0               WORK1 WITHOUT
00018B 4F90     2526          XFR   SETCNT2,XINA           THE NOISE
00018C 4F21     2529          XFR   SETCNT2,AR               BIT IF
00018D 8400     2532          ORI   WORK1,0                  ON
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                     2535             BOC    DBUS,TSTERRS
00018E 2095          2538 CHKNOIS     ANDM   SNSSTS2,RDNOISE         SET NOISE
00018F D701          2541             BOC    DBUS,SENSE2              IN BYTE 1
000190 2092          2544             ORI    SETCNT1,NOISE             IF ON
000191 8E80          2547 SENSE2      STO    LINK4,SENSE3            RETURN TO SENSE3
000192 1399          2550             STO    SETCNT2,0               CLEAR THIS REG (HOLDS FLAGS FOR SNS)
000193 0F00          2553             BU     SNSEVEN                 GO SHIP 2 BYTES
000194 61C9
000195 DB40          2557 TSTERRS     ANDM   FLAGS2,ALUFAIL          MASK ALU FAIL FLAG
000196 208F          2560             BOC    DBUS,CHKNOIS            BRANCH IF OFF
000197 8420          2563             ORI    WORK1,BUSOC             OTHERWISE SET BUS OUT CHK
000198 618F          2566             BU     CHKNOIS                 RETURN

                     2569 *   SENSE BYTES 2 AND 3

000199 8840          2572 SENSE3      ORI    STATIMG,SENSE           RESET SENSE TO DF
00019A 0200          2575             STO    XOUTAIM,0               CLEAR XOUTAIM (HOLDS CNT TO
00019B 8F40          2578             ORI    SETCNT2,SNSON            GATE BYTES FROM DF
00019C 139E          2581             STO    LINK4,SENSE4            RETURN TO SENSE 4
00019D 61C8          2584             BU     SNSEVEN1                GO BUMP ONE THEN SHIP EM

                     2587 *   SENSE BYTES 4 AND 5

00019E 0F00          2590 SENSE4      STO    SETCNT2,0               CLEAR REG FOR TEST
00019F 5521          2593             XFR    ALU1ERR,AR              DO WE
0001A0 5621          2596             XFR    ALU2ERR,AR               HAVE AN
0001A1 9F00          2599             ORM    SETCNT2,0                  ERROR
0001A2 20A5          2602             BOC    DBUS,SENSE5             BR IF NOT
0001A3 8480          2605             ORI    WORK1,ALUERR            SET ON IF SO
0001A4 CB3F          2608             AND    FLAGS2,ONES-ALUFAIL-FORCEUC  RESET ALU FAIL FLAGS
0001A5 0F20          2611 SENSE5      STO    SETCNT2,SNSOFF          SET FLAG TO TURN SNS OFF
0001A6 8E40          2614             ORI    SETCNT1,NSUBSYS         SET BIT TO INDICATE 3803
0001A7 13A9          2617             STO    LINK4,SENSE6            RETURN TO SENSE 6
0001A8 61C8          2620             BU     SNSEVEN1                GO BUMP ON THEN SHIP 2 MORE

                     2623 *   SENSE BYTES 6 AND 7

0001A9 13AB          2626 SENSE6      STO    LINK4,SENSE7            RETURN TO SENSE 7
0001AA 61C8          2629             BU     SNSEVEN1                GO TO BUMP XOUTAIM TO CLEAR BITS 6-7

                     2632 *   SENSE BYTES 8 AND 9

0001AB DA20          2635 SENSE7      ANDM   FLAGS1,CURFLAG          ARE WE RESERVED
0001AC 20AE          2638             BOC    DBUS,SENSE8             BR IF NOT
0001AD 8E01          2641             ORI    SETCNT1,CURSVD          TELL THE WORLD IF SO
0001AE 13B0          2644 SENSE8      STO    LINK4,SENSE9            RETURN TO SENSE 9
0001AF 61C9          2647             BU     SNSEVEN                  GO SHIP 'EM

                     2650 *   SENSE BYTES 10 AND 11

0001B0 5521          2653 SENSE9      XFR    ALU1ERR,AR              GET ALU1 ERRORS
0001B1 8E00          2656             ORI    SETCNT1,0                 IF SO
0001B2 13B4          2659             STO    LINK4,SENSEA            RETURN TO SENSEA
0001B3 61C9          2662             BU     SNSEVEN                 GO SHIP 'EM

                     2665 *   SENSE BYTES 12 AND 13

0001B4 0FC0          2668 SENSEA      STO    SETCNT2,SNSON+CNT40  DO SENSE AND ADD 40 WHEN APPLIES
0001B5 5660          2671             XFR    ALU2ERR,CBI             SEND ALU 2 ERRORS
0001B6 13B8          2674             STO    LINK4,SENSEB            RETURN TO SENSE B
0001B7 61CA          2677             BU     SNSEVEN2                GO SHIP 'EM

                     2680 *   SENSE BYTES 14 AND 15

0001B8 0F20          2683 SENSEB      STO    SETCNT2,SNSOFF          TURN SENSE OFF WHEN APPLIES
0001B9 13BC          2686             STO    LINK4,SENSEC            RETURN TO SENSEC
0001BA A240          2689             ADD    XOUTAIM,X'40'           BUMP GATES FOR HARDWARE
0001BB 61C9          2692             BU     SNSEVEN                 GO SHIP 'EM

                     2695 *   SENSE BYTES 16 AND 17

0001BC 0FC0          2698 SENSEC      STO    SETCNT2,SNSON+CNT40   TURN SENSE ON AND ADD 40
0001BD 13BF          2701             STO    LINK4,SENSED            RETURN TO SENSE D
0001BE 61C9          2704             BU     SNSEVEN                 GO SHIP 'EM

                     2707 *   SENSE BYTES 18 AND 19
0001BF C8BF          2710 SENSED      AND    STATIMG,ONES-SENSE      RESET SENSE IN REG
0001C0 0F00          2713             STO    SETCNT2,0               CLEAR FLAGS OUT
0001C1 13C3          2716             STO    LINK4,SENSEE            RETURN TO SENSEE
0001C2 61C9          2719             BU     SNSEVEN                 GO SHIP 'EM

                     2722 *   SENSE BYTES 20 AND 21

0001C3 13C5          2725 SENSEE      STO    LINK4,SENSEF            RETURN TO SENSE F
0001C4 61C9          2728             BU     SNSEVEN                 GO SHIP 'EM SOME MORE

                     2731 *   SENSE BYTES 22 AND 23
0001C5 5D21          2733 SENSEF      XFR    FRUREG,AR               GET ALU 1 FRU REG
0001C6 8400          2736             ORI    WORK1,0                   IN REG TO SEND
0001C7 13EF          2739             STO    LINK4,CANCEL1           THATS ALL - RETURN TO CANCEL

                     2742 **********************************************************************
                     2743 *   ENTRY TO SEND WORK1 AND SETCNT1 TO CHANNEL
0001C8 A201          2745 SNSEVEN1 ADD   XOUTAIM,1               BUMP GATES
0001C9 4460          2748 SNSEVEN  XFR   WORK1,CBI               SET ON CHANNEL BUS IN
0001CA 8808          2751 SNSEVEN2 ORI   STATIMG,SETSTATA        SET STAT A ON
0001CB 4242          2754 EXIT     XFR   XOUTAIM,XOUTA           THIS WILL SET CONTROLS
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0001CC 4828         2757          XFR   'STATIMG,STAT          TO HARDWARE
0001CD 1001         2760          STO   LINK1,BRETURN2       SET UP
0001CE 1193         2763          STO   LINK2,CANCEL           RETURN
0001CF 1293         2766          STO   LINK3,CANCEL             LINKAGE
0001D0 620A         2769          BU    SERVRTN              GO DO SERVICE
                    2771 **************************************************************
                    2773 **************************************************************
                    2774 *   RETURN AFTER SENDING THE EVEN SENSE BYTE
                    2775 **************************************************************

0001D1 DF40         2778 SNSODD   ANDM  SETCNT2,SNSON        SET SENSE ON
0001D2 20DA         2781          BOC   DBUS,SNSODD2         BR IF NOT
0001D3 8840         2784          ORI   STATIMG,SENSE        SET SENSE GATE FOR HDWE
0001D4 9F00         2787          ORM   SETCNT2,0            ADD ONE OR 40
0001D5 30DE         2790          BOC   CNT40,SNSODD3        BR IF ADD 40
0001D6 A201         2793          ADD   XOUTAIM,1            BUMP ONE
0001D7 C8F7         2796 SNSODD1  AND   STATIMG,ONES-SETSTATA  RESET STAT A
0001D8 4E60         2799          XFR   SETCNT1,CBI          SET ODD SENSE BYTE ON CBI
0001D9 61CB         2802          BU    EXIT                 RETURN TO PULL 2

0001DA DF20         2806 SNSODD2  ANDM  SETCNT2,SNSOFF       TURN OFF SENSE
0001DB 20D7         2809          BOC   DBUS,SNSODD1         BR IF NOT
0001DC C8BF         2812          AND   STATIMG,ONES-SENSE   DO IT IF OS
0001DD 61D7         2815          BU    SNSODD1              CONTINUE ON

0001DE A240         2819 SNSODD3  ADD   XOUTAIM,X'40'        BUMP GATE
0001DF 61D7         2822          BU    SNSODD1              CONTINUE SOME MORE

0001E0 4150         2826 SNSLINK  XFR   CTIMAGE,CTI          RESET SERVICE IN
0001E1 2AD1         2829          BOC   STATA,SNSODD         IF A ON GO TO SNS ODD
0001E2 3AE6         2832 PULL2    BOC   STATC,PULLAB         BR IF ALU2 DONE WITH
0001E3 3BF0         2835          BOC   STATD,CLEARAB         1ST 2 SENSE BYTES
0001E4 28EF         2838          BOC   ADROUT,CANCEL1       BR IF HIO
0001E5 61E2         2841          BU    PULL2                WAIT SOME MORE

0001E6 4490         2845 PULLAB   XFR   WORK1,XINA           GET EVEN SENSE BYTE FROM ALU2
0001E7 4E88         2848          XFR   SETCNT1,XINB         GET EVEN SENSE BYTE FROM ALU2
0001E8 8801         2851 NOTPULL  ORI   STATIMG,SETSTATD     SET D TO IND
0001E9 4828         2854          XFR   STATIMG,STAT          GOT 'EM
0001EA 28EF         2857 PULLAB1  BOC   ADROUT,CANCEL1       WAIT TO ASSURE
0001EB 3BED         2860          BOC   STATD,PULLAB2         ALU2 HAS SEEN D.
0001EC 3AEA         2863          BOC   STATC,PULLAB1          ON
0001ED C8FE         2866 PULLAB2  AND   STATIMG,ONES-SETSTATD   THEN RESET IT
0001EE 5322         2869          XFR   LINK4,IC             RETURN WITH 2 BYTES FROM ALU2

0001EF 6293         2873 CANCEL1  BU    CANCEL                           POINT SO EXIT

0001F0 0400         2877 CLEARAB  STO   WORK1,0              CLEAR WORK1
0001F1 0E00         2880          STO   SETCNT1,0            CLEAR COUNT REG 2
0001F2 61E8         2883          BU    NOTPULL              RETURN TO DO ONLY ALU1

000200              2887          ORG   BEGIN+X'200'
                    2888 ************************** SERVICE ROUTINE *************************
                    2889 *SERVICE IN SBR TESTS FOR ALL OUT TAGS DOWN, RAISES SERVICE IN AND   *
                    2890 *LINKS TO ADDRESSES STORED IN LNK 1 2 AND 3 WHEN A TAG IS RECEIVED IN *
                    2891 *REPLY                                                                *
                    2892 ********************************************************************

000200 65DB         2895 DMRRTN1  BU    DMRLNK               RETURN TO DMR ROUTINE
000201 61E0         2898 BRETURN2 BU    SNSLINK              RETURN TO SENSE OP
000202 6582         2901 BRETURN4 BU    DIALINK              RETURN TO SET DIAGNOSE

000203 1079         2905 WRTBGN   STO   LINK1,WRTEST         SET SERVICE SUBRTN RETURN
000204 1175         2908          STO   LINK2,WCOSTOP        SET STOP LINK
000205 1276         2911          STO   LINK3,WCOHIO         SET HIO LINK
000206 CCFB         2914          AND   SETDIA1,ONES-LWROP   RESET BIT FOR NEXT OPERATION
000207 8702         2917          ORI   SNSSTS2,WDCNTO       SET WORD COUNT ZERO ON
000208 4560         2920          XFR   PNDSTS,CBI           CLEAR BUS IN
000209 C400         2923          AND   WORK1,ZERO           CLEAR WORK REG 1

00020A 380C         2927 SERVRTN  BOC   OPRIN,SERVRTNO       BRANCH IF OP IN STILL UP(NO HIO)
00020B 5222         2930 HIOLK    XFR   LINK3,IC             RETURN TO HIO ENTRY

00020C 8108         2934 SERVRTNO ORI   CTIMAGE,SVCIN        MASK SERVICE IN UP
00020D 280B         2937 SERVRTN1 BOC   ADROUT,HIOLK         TEST FOR  HALT I/O
00020E 2D0D         2940          BOC   SVCOUT,SERVRTN1      WAIT FOR TAG TO FALL
00020F 290D         2943          BOC   CMDOUT,SERVRTN1      WAIT FOR TAG TO FALL
000210 390D         2946          BOC   SUPO,SERVRTN1        BRANCH TO SUPPRESS DATA
000211 4150         2949          XFR   CTIMAGE,CTI          RAISE SERVICE IN
000212 C1F7         2952          AND   CTIMAGE,ONES-SVCIN   MASK SERVICE IN DOWN

000213 280B         2956 SERVRTN2 BOC   ADROUT,HIOLK         TEST FOR HALT I/O
000214 2917         2959          BOC   CMDOUT,WHOA          STOPLINK TO PROGRAM
000215 2D32         2962          BOC   SVCOUT,TUTRTN        SERVICE OUT RESPONSE TO SERVICE IN
000216 6213         2965          BU    SERVRTN2             WAIT

                    2968 *** COMMAND OUT RESPONSE TO SERVICE IN SAYS STOP
000217 4150         2970 WHOA     XFR   CTIMAGE,CTI          DROP SERVICE IN
000218 5122         2973          XFR   LINK2,IC             LINK TO PROGRAM

                    2977 ************************** TEST TAPE UNIT **************************
                    2976 *THIS ROUTINE DETERMINES WHETHER THE TU STATUS PERMITS THE INITIATION *
                    2979 *OF THE COMMAND. IT THEN LINKS TO THE PROPER INITIAL STATUS ROUTINE   *
                    2980 ********************************************************************
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000219 1337        2983 TRETURN2 STO   LINK4,GRETURN0       SET MODE RETURN
00021A 6039        2986          BU    GODODIA              RETURN TO PRESENT MODE STATUS
00021B 63D9        2989 TRETURN3 BU    BSTWAIT2             NO-OP RETURN
00021C 60C7        2992 TRETURN0 BU    CMDPAR1              GO TO TERM UCK RTN
                   2995 *** PROTEST IS ENTERED ONLY BY WRITE TYPE COMMANDS TO CHECK FOR
                   2996 *** FILE PROTECT
00021D 13D0        2998 PROTEST  STO   LINK4,RTNPROT        SET OPENERS RETURN
00021E 60D3        3001          BU    OPENERS              GO CHECK DEVICE STATUS

00021F 3A2B        3005 PROTEST1 BOC   STATC,TUTESTIT       BRANCH IF NOT READY

000220 DC04        3009 CHKLWR   ANDM  SETDIA1,LWROP        MASK FOR LOOP WRITE TO READ OP
000221 2024        3012          BOC   DBUS,CHKNFP          BRANCH IF OFF
000222 8802        3015          ORI   STATIMG,SETSTATC     OTHERWISE SET STAT FOR ALU2
000223 4828        3018          XFR   STATIMG,STAT         SET TO HARDWARE

000224 D440        3022 CHKNFP   ANDM  WORK1,NFP            TEST FOR NOT FILE PROTECT
000225 312B        3025          BOC   DREG1,TUTESTIT       BRANCH IF NOT FP
000226 63F3        3028          BU    COMREJC1             GO TO COMMAND REJECT ROUTINE

000227 13D1        3032 TUTEST   STO   LINK4,RTNTUTST       SET OPENERS RETURN
000228 60D3        3035          BU    OPENERS              GO CHECK DEVICE STATUS

000229 13D2        3039 TUTEST1  STO   LINK4,RTNTUTS1       SET OPENERS RETURN
00022A 60D3        3042          BU    OPENERS              GO CHECK DEVICE STATUS

00022B DB80        3046 TUTESTIT ANDM  FLAGS2,FORCEUC       MASK FOR ALU FAILURE
00022C 301C        3049          BOC   DREG0,TRETURN0       BRANCH IF SO TO SET UNIT CHECK
00022D 0700        3052          STO   SNSSTS2,ZERO         RESET SENSE
00022E 4012        3055          XFR   CLEAR                RESET DATA FLOW SENSE

00022F 3A1C        3059 TUTEST2  BOC   STATC,TRETURN0       GO TO TERMINAL UNIT CHECK ROUTINE.
000230 DB80        3062          ANDM  FLAGS2,FORCEUC       IS FORCE UNIT CHK FLAG ON
000231 301C        3065          BOC   DREG0,TRETURN0       BR IF SO

000232 5022        3069 TUTRTN   XFR   LINK1,IC             LINK TO STATUS HANDLING ROUTINE

                   3073 ********************************* CONTROL COMMANDS ********************
                   3074 ***********************************************************************
                   3075 *CONTINIT ROUTINE HANDLES THE PRESENTATION OF INITIAL STATUS FOR ALL  *
                   3076 *ACCEPTED CONTROL IMMEDIATE COMMANDS.                                  *
                   3077 ***********************************************************************

000233 0508        3080 CONTINIT STO   PNDSTS,CHANEND       EMIT CHANNEL END STATUS
000234 104B        3083          STO   LINK1,SRETURN4       EMIT ACCEPT RETURN
000235 114C        3086          STO   LINK2,SRETURN5       EMIT STACK RETURN
000236 6038        3089          BU    GODODIA0             GO TO PRESENT STATUS

                   3092 *** CHANNEL RESPONDED WITH SERVICE OUT TO STATUS IN OR STATUS WAS
                   3093 *** ACCEPTED
000237 0500        3095 CONTSERV STO   PNDSTS,ZERO          RESET STATUS REGISTER
                   3097 *** ENTRY AT CONTSTAK SAYS THE CHANNEL RESPONDED TO STATUS IN WITH
                   3098 *** COMMAND OUT AND THE CHANNEL END IS STILL PENDING
000238 4242        3100 CONTSTAK XFR   XOUTAIM,XOUTA        SET DATA FLOW MASK
000239 4828        3103          XFR   STATIMG,STAT         RESET STAT D IF ON
00023A CCFB        3106          AND   SETDIA1,ONES-LWROP   RESET LWR BIT FOR NEXT OPERATION
00023B 2A43        3109          BOC   STATA,CKCHAIN        BRANCH IF REWIND OR DSE

00023C 4828        3113 GODOIT   XFR   STATIMG,STAT         SET STATS TO HDWE
00023D 5441        3116          XFR   XOUTBIM,XOUTB        TRAP ALU 2 TO PERFORM OP
00023E C1FE        3119 SKIPALU2 AND    CTIMAGE,ONES-OPIN   DROP OP IN
00023F 8110        3122          ORI   CTIMAGE,CUBUSY       RAISE CTI UNIT BUSY
000240 4150        3125          XFR   CTIMAGE,CTI          CHANGE TAGS

000241 3B54        3129 CTLWAIT  BOC   STATD,CHKERRS        IS ALU 2 FINISHED?
000242 6241        3132          BU    CTLWAIT              WAIT

000243 D901        3136 CKCHAIN  ANDM  FLAGS,CHAIN          MASK TO CHECK CHAIN BIT
000244 2049        3139          BOC   DBUS,CKEOTBOT        BRANCH IF NOT CHAINED
000245 DD40        3142          ANDM  SETDIA2,DEVBSY       TEST FOR DEV BSY FLG
000246 3148        3145          BOC   DREG1,RESETA         BRANCH IF ON TO RESET A STAT
000247 8801        3148          ORI   STATIMG,SETSTATD     SET STAT D TO INDICATE CHAING
000248 C8F7        3151 RESETA   AND   STATIMG,ONES-SETSTATA    RESET STAT A

000249 CDBF        3155 CKEOTBOT AND   SETDIA2,ONES-DEVBSY RST THE DEV BSY DIAG FLAG
00024A F007        3158          XOM   CURCOMM,X'07'        MASK FOR REWIND COMMAND
00024B 204F        3161          BOC   DBUS,CHKBOT          BRANCH IF IT IS TO CHECK BOT
00024C D420        3164          ANDM  WORK1,EOT            CMD IS DSE--CHECK EOT
00024D 203C        3167          BOC   DBUS,GODOIT          BRANCH IF NOT EOT
00024F 6251        3170          BU    RSTSTATA             GO RESET STAT A EOT IS ON

00024F D410        3174 CHKBOT   ANDM  WORK1,BOT            MASK TO CHECK BOT
000250 203C        3177          BOC   DBUS,GODOIT          BRANCH IF NOT ON
000251 C8F6        3180 RSTSTATA AND   STATIMG,ONES-SETSTATA-SETSTATD OT ON--RESET STATA
000252 4828        3183          XFR   STATIMG,STAT         RESET TO HDWE
000253 623E        3186          BU    SKIPALU2             GO TO SKIP ALU2 AND HANDLE INTRPT
000254 225E        3190 CHKERRS  BOC   ALUR,BIGPROB         WAS EXECUTION ERROR FREE?

                   3193 ******************************* CONTROL CMD END ************************
                   3194 * DETERMINE CONTROL CMD ENDING STATUS---ALU2 IS FINISHED. IF CHANNEL  *
                   3195 * END IS NOT PENDING AND NO OTHER STATUS IS TO BE PRESENTED, HAVE ALU2*
                   3196 * ARM THE DEVICE END PRIME. OTHERWISE SET STATUS PENDING FLAG. CHECK  *
                   3197 * FOR CATASTROPHIC ERROR IN ALU2 AND SET EQUIPMENT CHECK IF SO. GO TO *
                   3198 * TERMSTAT ROUTINE TO PRESENT STATUS IF THERE IS ANY.                 *
                   3199 ************************************************************************
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000255 3A5F    3203 CONTEND   BOC   STATC,SIGUC          BRANCH IF ALU2 SIGNALLED UNIT CHECK
000256 2765    3206           BOC   DFLER,WRTPROB        BRANCH IF DATA FLOW HAD AN ERROR
000257 2B63    3209 CONTEND1  BOC   STATB,SIGUX          BRANCH IF ALU2 SIGNALLED UNIT EXCP
000258 8504    3212 CONTEND2  ORI   PNDSTS,DEVEND        SET DEVICE END IN STATUS
000259 F504    3215 CONTEND3  XOM   PNDSTS,DEVEND        IS STATUS DEV END ALONE
00025A 2069    3218           BOC   DBUS,ONLYDE          BRANCH IF YES
00025B 2A69    3221           BOC   STATA,ONLYDE         BRANCH IF UNCHAINED RWD OR DSE
00025C 8904    3224           ORI   FLAGS,STATPNDG       SET STATUS PENDING FLAG
00025D 6299    3227           BU    TERMSTAT             GO TO TERMINAL STATUS

00025E 8710    3231 BIGPROB   ORI   SNSSTS2,EQUIPCK      SET EQUIPMENT CHECK IN SENSE DATA
00025F 8526    3234 SIGUC     ORI   PNDSTS,DEVEND+UNITCHK+CUE SET DE,CUE,UC IN STATUS
000260 C8F7    3237           AND   STATIMG,ONES-SETSTATA   RESET STAT IN REG
000261 4828    3240           XFR   STATIMG,STAT               FOR LATER
000262 6257    3243           BU    CONTEND1             GO BACK

000263 8525  I 3247 SIGUX     ORI   PNDSTS,DEVEND+UNITEXC+CUE SET DE,CUE,UX IN STATUS
000264 6258    3250           BU    CONTEND2             GO BACK

000265 8708    3254 WRTPROB   ORI   SNSSTS2,DATACK       SET DAT CHECK IN SENSE
000266 625F    3257           BU    SIGUC                 GO SET NIT CHECK

000267 C508    3261 NOTNOW    AND   PNDSTS,CHANEND       CLEAR PENDING STATUS REG
000268 629E    3264           BU    TERMSTA2             GO TO TERMINAL STATUS

000269 140A    3268 ONLYDE    STO   XOUTBIM,NDXSDE-ALU2BRT EMIT ALU2 BRANCH ADDRESS          ***
00026A 5441    3271           XFR   XOUTBIM,XOUTB        TRAP ALU2 TO SET DE PRIME
00026B C8FC    3274           AND   STATIMG,ONES-SETSTATC-SETSTATD RESET STATS C AND D
00026C 4828    3277           XFR   STATIMG,STAT         SET TO HDWE
00026D 3B97    3280 DEDUN     BOC   STATD,CKDEER         BRANCH IF DONE
00026E 3A97    3283           BOC   STATC,CKDEER         BRANCH IF ALU2 HAS PRIMED
00026F 626D    3286           BU    DEDUN                GO BACK IF NOT DONE

               3289 ***********************************************************************
               3290 *CLEANIT  ROUTINE HANDLES THE PRESENTATION OF INITIAL STATUS FOR ALL  *
               3291 *ACCEPTED NON IMMEDIATE COMMANDS EXCEPT SENSE.                        *
               3292 ***********************************************************************


000270 0500    3295 CLEANIT   STO   PNDSTS,ZERO          EMIT CLEAN STATUS
000271 104D    3298           STO   LINK1,SRETURN6       EMIT ACCEPT RETURN
000272 1156    3301           STO   LINK2,WATESUM        EMIT STACK RETURN
000273 6038    3304           BU    GODODIA0             GO SET DIAGNOSTIC FLAGS

               3307 *
               3308 ***************************** WRITE ROUTINE ****************************
               3309 ***********************************************************************
               3310 * WRITINIT FETCHES THE FIRST BYTE OF WRITE DATA, CHECKS FOR WORD COUNT*
               3311 * ZERO AND TRAPS ALU2 TO EXECUTE THE WRITE OP. IN ADDITION, A RIPPLE  *
               3312 * PATTERN IS GENERATED FOR OFF LINE MODE. THE PATTERN IS UPDATED AT   *
               3313 * EACH SERVICE OUT AND XFERRED TO CHAN BUS IN REG. IN OFF LINE MODE   *
               3314 * THE CHAN BUS IN REG IS WRAPPED AROUND TO CHAN BUS OUT TO PROVIDE    *
               3315 * RIPPLE WRITE DATA. REQ TIE AND SET DIAGNOSE COMMANDS WILL ALSO USE  *
               3316 * THIS ROUTINE TO FETCH THE FIRST BYTE OF DATA.                       *
               3317 ***********************************************************************


000274 616C    3320 BRETURN1  BU    DOTIEMS1             RETURN TO TIE MODE SET ROUTINE

000275 63DC    3324 WCOSTOP   BU    SETUNTCK             GE SET DATA CHECK DEV NOT STARTED

000276 050E    3328 WCOHIO    STO   PNDSTS,CHANEND+DEVEND+UNITCHK SET DE,CE,AND UC IN STATUS
000277 8904    3331           ORI   FLAGS,STATPNDG       SET STATUS PENDING FLAG
000278 634B    3334           BU    HIONOP               GO TO HIO NOT OPERATING

000279 C7FD    3338 WRTFST    AND   SNSSTS2,ONES-WDCNT0 RESET WORD COUNT ZERO IN SENSE
00027A D0C8    3341           ANDM  CURCOMM,X'C8'        MASK FOR MODE SET TYPE CMD
00027B 307D    3344           BOC   DREG0,BUMPRIP        BRANCH IF LWR CMD
00027C 3474    3347           BOC   DREG4,BRETURN1       BRANCH IF SO

00027D 5441    3351 BUMPRIP   XFR   XOUTBIM,XOUTB        TRAP ALU2 TO DO WRITE
00027E 8880    3354           ORI   STATIMG,STOP         SET STOP STAT IN IMAGE REG

00027F 2883    3358 WRTSTART  BOC   ADROUT,WRTHIO        BRANCH IF HIO
000280 2884    3361           BOC   STATB,WRTMOVE1       BRANCH IF DEVICE STARTED            ****
000281 3B95    3364           BOC   STATD,SETSTOP1       BRANCH IF ALU2 STOPPED
000282 627F    3367           BU    WRTSTART             GO BACK UNTIL SOMETHING HAPPENS
000283 6354    3371 WRTHIO    BU    HIOPERG                 GO TO HIO OPERATING ROUTINE

000284 4150    3375 WRTMOVE1  XFR   CTIMAGE,CTI          DROP SERVICE IN TO HDWR             ***
000285 2883    3378 WRTMOVE2  BOC   ADROUT,WRTHIO        BRANCH IF HIO
000286 3F94    3381 CKOVRN    BOC   OVERRUN,SETSTOP      BRANCH IF OVERRUN
000287 2D85    3384           BOC   SVCOUT,WRTMOVE2      WAIT FOR SVC OUT TO FALL            *****
000288 4460    3387           XFR   WORK1,CBI            MOVE PATTERN TO CHAN BUS IN
000289 2883    3390 WRTMOVE   BOC   ADROUT,WRTHIO        BRANCH IF HIO ISSUED
00028A 2D8E    3393           BOC   SVCOUT,BUMPGEN       BRANCH IF NEXT DATA BYTE READY
00028B 2992    3396           BOC   CMDOUT,CHKBSO        BRANCH IF STOP ISSUED
00028C 3B92    3399 CHKSTOP   BOC   STATD,CHKBSO         BRANCH IF ALU2 TERMINATES EARLY
00028D 6289    3402           BU    WRTMOVE              GO BACK AND REITERATE TEST LOOP

00028E A401    3406 BUMPGEN   ADD   WORK1,BUMP1          BUMP OFF-LINE PATTERN GENERATOR
00028F 6285    3409           BU    WRTMOVE2             RETURN                              *****

000290 8720    3413 WRTBOCK   ORI   SNSSTS2,BUSOC        SET BUS OUT CHK IN SENSE DATA
000291 6294    3416           BU    SETSTOP              RETURN TOSET STOP
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000292 2490     3420 CHKBSO    BOC   BOPE,WRTBOCK          BRANCH IF CHAN BUS OUT PARITY EVEN
000293 C8B7     3423 CANCEL    AND   STATIMG,ONES-SENSE-SETSTATA   RESET SENSE STATS
000294 8880     3426 SETSTOP   ORI   STATIMG,STOP          SET STOP IN STAT IMAGE REG
000295 4828     3429 SETSTOP1  XFR   STATIMG,STAT          XFR IMAGE REG TO HDWE STAT REG
000296 63B7     3432           BU    BSTWAIT               GO WAIT FOR ALU2 COMPLETION

000297 225F     3436 CKDEER    BOC   ALUR,SIGUC            BRANCH IF ALU ERROR
000298 2A67     3439           BOC   STATA,NOTNOW          BRANCH IF REWIND OR DSE
                3442 ******************************** TERMINAL STATUS *************************
                3443 * TERMINAL STATUS IS USED BY ALL FUNCTIONAL COMMANDS TO PRESENT         *
                3444 * ENDING STATUS.  THE CALLING ROUTINE, UP ON ENTRY, MUST HAVE SET THE *
                3445 * PENDING DEVICE ADDRESS REG AND THE PENDING STATUS REG.  TERM STAT    *
                3446 * WILL DETERMINE IF CONTROL UNIT END MUST BE ADDED TO THE STATUS AND  *
                3447 * THEN WILL PRESENT THE STATUS IN THE APPROPRIATE MANNER. IF THE CHAN-*
                3448 * NEL REMAINED CONNECTED STATUS IN WILL BE RAISED IMMEDIATELY. IF NOT *
                3449 * AN INTERRUPT CYCLE WILL BE INITIATED WITH THE APPROPRIATE REQUEST-  *
                3450 * IN DEPENDING ON CHAINING. CONTROL UNIT BUSY WILL BE RESET IF APPLI- *
                3451 * CABLE AND HOLD INTERFACE WILL BE SET IF STATUS PENDING OR STACK FLAG*
                3452 * IS SET. IF PENDING STATUS IS CLEAN (RWD OR DSE) STATUS WILL NOT BE  *
                3454 * ROUTINE UNDER THE CONTROL OF STATA. A GENERAL RESET WILL BE TERM-   *
                3455 * INATED BY THIS ROUTINE VIA IDLESCAN.                                 *
                3456 **********************************************************************

000299 38A8     3459 TERMSTAT  BOC   OPRIN,TERMSTA1        IS OP-IN UP

00029A 2344     3463 BHERE     BOC   MIFTR,CHKCONT         BRANCH IF MIS AVAILABLE             ***

00029B D986     3467 TERMSTA0  ANDM  FLAGS,STATPNDG+STACK+CONCON NEED TO HOLD INTF
00029C 209E     3470           BOC   DBUS,TERMSTA2         NO, SKIP TO RESET CUB
00029D 8120     3473           ORI   CTIMAGE,HOLDINT       RAISE HOLD INTERFACE

00029E          3476 TERMSTA2  EQU   *
00029E C8F5     3478           AND   STATIMG,ONES-SETSTATA-SETSTATC    (DSE OR RWD SWITCH)
00029F 4828     3481           XFR   STATIMG,STAT          SET STATS TO HDWE
0002A0 C1EF     3484           AND   CTIMAGE,ONES-CUBUSY   RESET CONTROL UNIT BUSY
0002A1 4150     3487           XFR   CTIMAGE,CTI           XFR CHANNEL TAG IMAGE TO HDWE

0002A2 2339     3491 TERMSTA3  BOC   MIFTR,MIFTR05         BRANCH IF MIS AVAILABLE             ***
0002A3 25AE     3494 ANYCUEA   BOC   NCUEA,CHKAFLG         BRANCH IF NOT CUE ON A
0002A4 8520     3497           ORI   PNDSTS,CUE            SET CONTROL UNIT END IN STATUS
0002A5 8940     3500           ORI   FLAGS,CUEA            SET CONTROL UNIT END IN FLAGS
0002A6 4009     3503           XFR   CUREA                 ATTEMPT TO RESET CUEA
0002A7 62A3     3506           BU    ANYCUEA               GO CHECK RESET

0002A8 8101     3510 TERMSTA1  ORI   CTIMAGE,OPIN          RAISE MICROPGM OP IN
0002A9 28AC     3513           BOC   ADROUT,HADHIO         BRANCH IF HIO
0002AA 4150     3516           XFR   CTIMAGE,CTI           SET TO HARDWARE
0002AB 389A     3519           BOC   OPRIN,BHERE           OP IN STILL UP?
0002AC C1FE     3522 HADHIO    AND   CTIMAGE,ONES-OPIN     RESET UPGM OP IN
0002AD 629A     3525           BU    BHERE                 NO, CHANNEL DISCONNECTED

0002AE 4009     3529 CHKAFLG   XFR   CUREA                 RESET GEN RESET LATCH IF ON
0002AF D940     3532           ANDM  FLAGS,CUEA            MASK FOR CUE A FLAG
0002B0 20B2     3535           BOC   DBUS,CHKCHAIN         BRANCH IF OFF
0002B1 852C     3538 CUEPNDG   ORI   PNDSTS,CUE            SET CUE IN STATUS

0002B2 9500     3542 CHKCHAIN  ORM   PNDSTS,0              STATUS IS CLEAN IF RWD OR DSE
0002B3 20BA     3545           BOC   DBUS,CHEKTIO          BRANCH IF SO TO PREVENT INTERRUPT
0002B4 38C3     3548 TERMSTA4  BOC   OPRIN,STSIMME         BRANCH IF CHANNEL STILL CONNECTED
0002B5 D901     3551           ANDM  FLAGS,CHAIN           MASK TO TEST CHAINING

0002B6 20BD     3554           BOC   DBUS,NOTCHAIN         BRANCH IF CHAIN BIT OFF
0002B7 234A     3557           BOC   MIFTR,MIFTR06         BRANCH IF MIS AVAILABE              $$$
0002B8 8A04     3560 SETREQA   ORI   REQTAGS,REQINA        RAISE NON SUPPRESSIBLE REQ-IN A
0002B9 62C1     3563           BU    GOTOIDLE              GO WAIT FOR POLL

0002BA 9000     3567 CHEKTIO   ORM   CURCOMM,0             MASK FOR TIO CMD
0002BB 20B4     3570           BOC   DBUS,TERMSTA4         BRANCH IF IT IS
0002BC 6304     3573           BU    IDLESCAN              OTHERWISE GO LOOK FOR STATUS
0002BD DD20     3577 NOTCHAIN  ANDM  SETDIA2,BLKINTS       MASK FOR DIAGNOSTIC BLOCK INTERRUPT
0002BE 32C2     3580           BOC   DREG2,GODOIDLE        BRANCH IF ON TO BYPASS REQUEST-IN
0002BF 234E     3583           BOC   MIFTR,MIFTR07         BRANCH IF MIS AVAILABLE             ***
0002C0 8A08     3586 DOREQA    ORI   REQTAGS,SUPREQA       RAISE SUPPRESSIBLE REQUEST IN A
0002C1 4A48     3589 GOTOIDLE  XFR   REQTAGS,MIST          RAISE REQ-IN TO HARDWARE
0002C2 6302     3592 GODOIDLE  BU    IDLEPEND              WAIT FOR POLL

0002C3 1048     3596 STSIMME   STO   LINK1,SRETURN0        LOAD STS SUBRTN ACCEPT RETURN
0002C4 1149     3599           STO   LINK2,SRETURN1        LOAD STS SUBRTN STACK RETURN
0002C5 1249     3602           STO   LINK3,SRETURN1        LOAD STS SUBRTN HALT RETURN
0002C6 604E     3605           BU    STATRTN               GO TO STATUS SUBROUTINE

                3608 **********************************************************************
                3609 * TERMSTAK IS ENTERED WHEN ENDING STATUS IN RECEIVES A COMMAND OUT     *
                3610 * RESPONSE (STACK). INBOUND TAGS WILL BE RESET,BUSY WILL BE REMOVED.  *
                3611 * FROM THE STATUS (IF APPLICABLE), THE OPPOSITE INTERFACE WILL BE      *
                3612 * RELEASED FROM PING HOLD (IF APPLICABLE), AND A NORMAL ENDUP EXIT    *
                3613 **********************************************************************
0002C7 8120     3615 TERMSTAK  ORI   CTIMAGE,HOLDINT       RAISE HOLD INTERFACE
0002C8 4044     3618           XFR   PING                  RELEASE THE OTHER INTERFACE

0002C9 C1FC     3622 TERMSTK1  AND   CTIMAGE,ONES-OPIN-ADDIN  RESET OPIN AND ADRESS IN
0002CA C5EF     3625           AND   PNDSTS,ONES-BUSY      RESET BUSY BIT IN STATUS
0002CB C400     3628 GETOFF    AND   WORK1,ZERO            CLEAR WORK1
0002CC 62E5     3631           BU    CLEANUP               GO TO RAISE REQ-IN
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               *****************************************************************
               * TERMACC IS ENTERED WHEN ENDING STATUS IN RECEIVES A SERVICE OUT *
               * RESPONSE (STATUS ACCEPTED). IF CHAINING OR CONTINGENT CONNECTION IS *
               * INDICATED, THE DEVICE WILL REMAIN COMMITTED. STAT D WILL BE SET TO *
               * NOTIFY ALU2 TO CLEAR A DEVICE END PRIME IF APPLICABLE. THE HOLD *
               * INTERFACE LINE WILL BE RAISED IF THE RESERVE FLAG,CHAIN FLAG,OR *
               * CONTINGENT CONNECTION FLAG IS ON. INBOUND TAGS WILL BE RESET AND *
               * CHAN BUS IN WILL BE CLEARED. IF NOT CHAINING EXIT WILL BE TO IDLE *
               * TO SCAN FOR STATUS. IF CHAINING, A LOOP HANGING ON SUPPRESS OUT WILL*
               * BE EFFECTED. IF CHANNEL CALLS CHAIN OFF SUPPRESS OUT WILL DROP *
               *****************************************************************

0002CD C1FE    TERMACC   AND   CTIMAGE,ONES-OPIN   RESET OP IN
0002CE 0400              STO   WORK1,0             CLEAR A WORK REG
0002CF D981              ANDM  FLAGS,CHAIN+CONCON  MASK TO CHECK CHAIN AND CONT CONN
0002D0 20D2              BOC   DBUS,CKRESRV        BRANCH IF BOTH OFF
0002D1 62D4              BU    DROPTAGS            OTHERWISE GET OUT

0002D2 2352    CKRESRV   BOC   MIFTR,MIFTR08       BRANCH IF MIS AVAILABLE           ***

0002D3 C1DF    RSTHLDIN  AND   CTIMAGE,ONES-HOLDINT RESET HOLD INTERFACE

0002D4 D504    DROPTAGS  ANDM  PNDSTS,DEVEND       MASK FOR DEVICE END
0002D5 20E9              BOC   DBUS,MOVEON         BRANCH IF NOT
0002D6 8801              ORI   STATIMG,SETSTATD    NOTIFY ALU2 TO CLEAR DEP
0002D7 4828              XFR   STATIMG,STAT        XFR STATIMG TO HDWE STAT REG

0002D8 3BE9    RSTNTDUN  BOC   STATD,MOVEON        ALU2 DONE
0002D9 62D8              BU    RSTNTDUN            NO, GO BACK

0002DA 9500    DODES     ORM   PNDSTS,0             MASK FOR CLEAN STATUS
0002DB 62F7              BU    BLOUT20             BLOW OUT TO CHECK UC          EC 734124
0002DC D5C7    FROM20    ANDM  PNDSTS,ONES-CUE-CUBUSY-CHANEND MASK FOR DES STAECS734124
0002DD 20E2              BOC   DBUS,ALLCLEAR       BRANCH IF NONE
0002DE 1406    DODES1    STO   XOUTBIM,NDXDES-ALU2BRT FETCH ALU2'S DESELECT DEVICE RTN
0002DF 5441              XFR   XOUTF.M,XOUTB       TRAP ALU2 TO RESET DEV COMMITTED LCH

0002E0 3BE2    DOITAGN   BOC   STATD,ALLCLEAR      BRANCH IF ALU2 COMPLETED
0002E1 62E0    RSTCMTD   BU    DOITAGN             GO BACK IF NOT

0002E2 22E5    ALLCLEAR  BOC   ALUR,CLEANUP        TRAP HERE IF ALU2 HDWE ERROR
0002E3 C400              AND   WORK1,ZERO          CLEAR A WORK REG
0002E4 4424              XFR   WORK1,TUADR         RESET DEV ADDRESS REG
0002E5 4460    CLEANUP   XFR   WORK1,CBI           CLEAR BUS IN
0002E6 4150              XFR   CTIMAGE,CTI         RESET CHANNEL TAGS
0002E7 38E7    OPINDROP  BOC   OPRIN,OPINDROP      WAIT FOR OP IN TO FALL
0002E8 6304              BU    IDLESCAN            GO TO IDLESCAN TO LOOK FOR INTS

0002E9 22EC    MOVEON    BOC   ALUR,CLRBUSIN       ALU2 ERROR TRAP HERE
0002EA D981              ANDM  FLAGS,CHAIN+CONCON  MASK TO CHECK CHAIN AND CONT CONN
0002EB 20DA              BOC   DBUS,DODES          DESELECT DEVICE IF BOTH OFF
0002EC D901    CLRBUSIN  ANDM  FLAGS,CHAIN         MASK FOR CHAIN
0002ED 20E5              BOC   DBUS,CLEANUP        BRANCH IF NOT (CONT CONN)
0002EE 4460              XFR   WORK1,CBI           CLEAR CHAN BUS IN
0002EF DD10              ANDM  SETDIA2,CUBUSY      MASK FOR DIAGNOSTIC CU BUSY FLAG
0002F0 20F3              BOC   DBUS,RLSCHANN       BRANCH IF OFF TO LEAVE CU NOT BUSY
0002F1 8110              ORI   CTIMAGE,CUBUSY      SET CU BUSY
0002F2 CDEF              AND   SETDIA2,ONES-CUBUSY RESET THE FLAG
0002F3 4150    RLSCHANN  XFR   CTIMAGE,CTI         DROP OP IN
0002F4 39F4    YESCHAIN  BOC   SUPO,YESCHAIN       WAIT HERE UNTIL TRAPPED FOR
               *                                   ANOTHER SELECTION OR RESET CHAIN
               *                                   IF SUPPRESS OUT DROPS
0002F5 C9FE              AND   FLAGS,ONES-CHAIN    RESET CHAIN BIT WE FELL THRU
0002F6 62DE              BU    DODES1              GO TO SCAN FOR STATUS OR SOECT734124
0002F7 20DE    BLOUT20   BOC   DBUS,DODES1         BRANCH IF CLEAN STS TO DES EC 734124
0002F8 36E5              BOC   DREG6,CLEANUP       BRANCH IF UNIT CHECK       EC 734124
0002F9 62DC              BU    FROM20              RETURN TO DESELECT         EC 734124
                         ORG   BEGIN+X'300'
               ****************************** IDLESCAN *********************************
               * IDLESCAN SERVES PRIMARILY THREE FUNCTIONS:                            *
               *        1.SCAN FOR CONTROL UNIT ENDS ON BOTH A AND B INTERFACES        *
               *        2.SCAN FOR DEVICE ENDS OWED DUE TO DE PRIME BITS BEING SET     *
               *        3.MAINTAIN INTERFACE ENABLE/DISABLE SWITCHES                   *
               *                                                                       *
               * THE PRIOR SEQUENCE DEPICTS THE ACTUAL SCANNING SEQUENCE. THE CONTROL*
               * UNIT END LATCH FOR THE LAST SELECTING CHANNEL WILL BE SCANNED FIRST *
               * AND THE DEVICE ENDS DUE TO DE PRIMES WILL BE PRESENTED TO INTERFACE *
               * A FIRST.                                    IN ALL THE CASES PREV-  *
               * IOUSLY MENTIONED, A CONTROL UNIT RESERVED WILL RESULT IN ONLY THE   *
               * RESERVING INTERFACE BEING INTERRUPTED FOR THE DURATION OF THE RESERV*
               * ALL STATUS WILL BE HELD FOR THE OPPOSITE INTERFACE AND WILL BE PRES-*
               * ENTED UPON THE CONTROLLERS RELEASE.                                 *
               *   WHEN A DEVICE END HAS BEEN FOUND BY ALU2, ALU1 WILL REQUEST TO    *
               * PRESENT STATUS TO THE PROPER INTERFACE. IN THE MEANTIME,ALU2 WILL BE*
               * SPINNING ON ALU1'S STAT D WHICH INDICATES ALU2 IS TO RELEASE THE    *
               * DEV END PRIME. STAT D WILL BE SET BY ALU1 ONLY WHEN THE CHANNEL     *
               * HAS ACCEPTED THE STATUS. SHOULD ALU1 RECEIVE A NON-POLLING INITIAL  *
               * SELECTION DURING THE INTERIM, ALU2 WILL BE TRAPPED TO LOCATION 0 AND*
               * THE INTERRUPTING DE PRIME WILL NOT BE RESET.                        *
               *   AFTER A COMPLETE SCAN HAS BEEN EXECUTED AND NO INTERRUPTABLE STS  *
               * FOUND, AN ALU CHECKOUT ROUTINE WILL BE ENTERED. UPON COMPLETION OF  *
               * THE ALU CHECKOUT IDLESCAN WILL BE RE-INVOKED. ANY ERROR IN THE ALU  *
               * CHECKOUT WILL RESULT IN A MICROCODE FORCED ALU ERROR TRAP           *
               *  BOTH INTERFACE CHAIN HOLD LINES WILL ALSO BE MAINTAINED IN IDLE.   *
               *  IF ANY STATUS IS FOUND(OUTSTANDING OK COMPLETED) THE CHAIN HOLD    *
               *  LINE FOR THE RESPECTIVE INTERFACE WILL REMAIN ON. THE CHAIN HOLD   *
               *  LINES BLOCK DISABLING AN INTERFACE IF THE CONTROLLER IS HOLDING ANY*
               *  STATUS FOR THAT INTERFACE.                                         *
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000300 4011        3829 TROUBLE   XFR   HDWERR                  FORCE A HARD ERROR
000301 6301        3832 HANGHERE  BU    HANGHERE                WAIT FOR SIO TIO OR SUMPIN
000302 6302        3835 IDLEPEND  BU    IDLEPEND                WAIT FOR SOMETHING TO HAPPEN
000303 62C0        3838 DRETURNO  BU    DOREQA                  GO DEVICE RESERVED TO A.

000304 631F        3842 IDLESCAN  BU    CHKOPIN                 BRANCH TO WAIT FOR OPIN FALEC 732423
000305 4150        3845 IDLE      XFR   CTIMAGE,CTI             XFR TO HARDWARE           EC 732423
000306 D906        3848           ANDM  FLAGS,STACK+STATPNDG MASK FOR STACKED AND STS PNDNG
000307 2009        3851           BOC   DBUS,IDLEO              BRANCH IF NOT
000308 62BD        3854           BU    NOTCHAIN                GO RAISE REQ-IN

000309 CBC0        3858 IDLEO     AND   FLAGS2,X'C0'            RESET FRU REG             FC 732421
00030A AB01        3861           ADD   FLAGS2,1                BUMP FRU REG
00030B 23CB        3864           BOC   MIFTR,MIFTR17           BRANCH IF MIS             EC 732421
00030C F506        3867 IDLE1     XOM   PNDSTS,UNITCHK+DEVEND MASK FOR DEP STATUS         EC 732421
00030D 2010        3870           BOC   DBUS,SETSPIN            BRANCH IF IT IS
00030E 8500        3873           ORI   PNDSTS,0                MASK LAST STATUS PRESENTED
00030F 3601        3876           BOC   DREG6,HANGHERE          BRANCH IF UNIT CHECK IS ON

000310 2200        3880 SETSPIN   BOC   ALUR,TROUBLE            BRANCH IF ALU2 HAD AN ERR EC 732421
000311 140B        3884           STO   XOUTBIM,NDXABRT-ALU2BRT SET ALU2 TO INIT          EC 732421
000312 5441        3887 SETSPIN1  XFR   XOUTBIM,XOUTB               TRAP ALU2

000313 3B15        3891 SETSPIN2  BOC   STATD,CLRSTS            WAIT UNTIL
000314 6313        3894           BU    SETSPIN2                    ALU2 FINISHES

000315 0500        3898 CLRSTS    STO   PNDSTS,ZERO             CLEAR PENDING STATUS REG
000316 003F        3901           STO   CURCOMM,ONES-192        INSURE LST CMD IS NOT TIO FOR CUE
                   3903 *                                       SEARCH IN TERMSTAT
000317 2355        3905           BOC   MIFTR,MIFTR09           BRANCH IF MIS AVAILABLE         ***

000318 2A24        3909 ITSRSVD   BOC   STATA,RSTRESET          GO LOOK FOR DEP IF STAT A EC 732421
000319 8808        3912           ORI   STATIMG,SETSTATA        SET 1ST SWITCH ON
00031A 4828        3915           XFR   STATIMG,STAT            SET TO HARDWARE
00031B 62A2        3918           BU    TERMSTA3                GO CHECK FOR CUE ON RESERVED INTF

00031C 1D00        3922 REGINIT   STO   FRUREG,0                CLEAR FRU REG             EC 732423
00031D 0000        3925           STO   CURCOMM,0               CLEAR REG 0 PER XFR5      EC 732423
00031E 6363        3928           BU    CHKONB                  RETURN TO RESET           EC 7324²³
00031F C1EF        3931 CHKOPIN   AND   CTIMAGE,ONES-CUBUSY RESET CONTROL UNIT BUSY       EC 732423
000320 3820        3934 OPINUP    BOC   OPRIN,OPINUP            WAIT FOR OP IN FALL       EC 732423
000321 6305        3937           BU    IDLE                    RETURN TO IDLE            EC 732423
000322 23DD        3940 CHKONA    BOC   MIFTR,MIFTR18           BRANCH IF MIS AVAILABLE   EC 732423
000323 62BD        3943           BU    NOTCHAIN                GO RAISE REQ-IN           EC 732423

000324 C9F7        3947 RSTRESET AND    FLAGS,ONES-RESETOK   RESET THE  ALL RESET FLAG EC 732421
                   3950 *********************************************************************
                   3951 * DEPRIMES WILL SEARCH ALL DEVICES FOR ANY OUTSTANDING PRIMES AND    *
                   3952 * CHECK THE DEVICE TO SEE IF IT IS STILL BUSY. WHEN A DEVICE IS FOUND *
                   3953 * NOT BUSY,A CHECK WILL BE MADE TO SEE IF IT IS READY. IF READY,THE  *
                   3954 * CONTROLLER WILL RAISE REQ-IN TO THE APPROPRIATE PATH AND WAIT FOR  *
                   3955 * SELECTION TO PRESENT DEVICE END ALONE. IF NOT READY, DEVICE END,   *
                   3956 * UNIT CHECK WILL BE PRESENTED.                                      *
                   3957 *  DEVICE END PRIMES ARE SET ON ANY CONTROL CMD THAT COMPLETES WITHOUT*
                   3958 * EXCEPTIONAL STATUS, A TIO TO A BUSY DEVICE(DUE TO SWITCHED), AND   *
                   3959 * REWIND AND DATA SECURITY ERASE COMMANDS AT CHANNEL END TIME.       *
                   3960 *  ON INITIAL KICKOFF ALU2'S STATS ACTIVE HAVE THE FOLLOWING MEANING: *
                   3961 *             ALU2 STAT B = ALU2 FOUND A DEVICE END PRIME            *
                   3962 *                           FOR THE DESIRED INTERFACE(A OR B)        *
                   3963 *             ALU2 STAT D = ALU2 DID NOT FIND ANY DEP'S FOR THE      *
                   3964 *                           DESIRE INTERFACE.                        *
                   3965 *                                                                    *
                   3966 *  IF ALU2 FOUND A PRIME,THEN THE STATS WILL MEAN:                   *
                   3967 *             ALU1 STAT C = ALU1 HAS SET THE DEVICE ADDRESS PROVIDED *
                   3968 *                           BY ALU2 IN THE TU ADDRESS REG ALONG WITH *
                   3969 *                           SWITCH SELECT.                           *
                   3970 *             ALU2 STAT B = ALU2 FOUND DEVICE WAS STILL BUSY BUT HAS *
                   3971 *                           ANOTHER DEP FOR ANOTHER DEVICE           *
                   3972 *             ALU2 STAT C = ALU2 FOUND DEVICE WAS NOT BUSY BUT READY *
                   3973 *                           WAS DROPPED.                             *
                   3974 *             ALU2 STAT B AND STAT C = ALU2 FOUND DEVICE NOT BUSY    *
                   3975 *                                      AND READY                     *
                   3976 *             ALU2 STAT D = ALU2 HAS NO MORE DEP'S TO CHECK          *
                   3977 *                                                                    *
                   3978 *             ALU2 STAT B AND STAT D = ALU2 FOUND LAST DEVICE BUSY   *
                   3979 *                                      AND NO MORE DEP'S             *
                   3980 *                                                                    *
                   3981 * IF CONTROLLER IS RESERVED ONLY THE DEP'S FOR THE RESERVED INTERFACE *
                   3982 * WILL BE SCANNED.                                                   *
                   3983 *********************************************************************
000325 0800        3985 DEPRIMES STO    STATIMG,ZERO            CLEAR ALL STATS
000326 0504        3988          STO    PNDSTS,DEVEND           SET DEV END IN PNDING STATUS REG
000327 AB01        3991          ADD    FLAGS2,1                BUMP FRU REG
000328 2362        3994          BOC    MIFTR,MIFTROC           BRANCH IF MIS AVAILABLE         ***

000329 C9DF        3998 DEPRIM1  AND    FLAGS,ONES-INTFB        RESET INTF B FLAG

00032A 4828        4002 DEPRIM2  XFR    STATIMG,STAT            XFR STATS TO HDWE
00032B 1407        4005          STO    XOUTBIM,NDXPOLL-ALU2BRT  EMIT ALU2 BRANCH ADDRESS ***
00032C 5441        4008          XFR    XOUTBIM,XOUTB           TRAP ALU2

00032D 2B30        4012 DEPRIM3  BOC    STATB,DEPRIM4           BRANCH IF ALU2 FOUND DEP
00032E 3B41        4015          BOC    STATD,DEPRIM7           BRANCH IF ALU2 FINISHED
00032F 632D        4018          BU     DEPRIM3                 GO BACK AND LOOK SOME MORE
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000330 4828        4022 DEPRIM4  XFR.  STATIMG,STAT          SET STATS TO HDWE
000331 3B41        4025          BOC   STATD,DEPRIM7         BRANCH IF DONE AND BSY DEV

000332 3A40        4029          BOC   STATC,DEPRIMA         BRANCH IF ALU2 FOUND DEV NOT BUSY
000333 4688        4032          XFR   PNDADDR,XINB          FETCH DEP ADDRESS FROM ALU2
000334 4624        4035          XFR   PNDADDR,TUADR         SWITCH SELECT THE DEVICE
000335 8802        4038          ORI   STATIMG,SETSTATC      SET STEP ALU2 STAT
000336 4828        4041          XFR   STATIMG,STAT          XFR IMAGE TO HDWE
000337 C8FD        4044          AND   STATIMG,ONES-SETSTATC RESET STAT C
000338 633C        4047          BU    INSDELAY               BRANCH TO INSERT DELAY

000339 3A3D        4051 DEPRIM5  BOC   STATC,DEPRIM6         BRANCH IF ALU2 FOUND DEV NOT BSY
00033A 2B30        4054          BOC   STATB,DEPRIM4         BRANCH IF ALU2 FOUND DEV BUSY
00033B 3B41        4057          BOC   STATD,DEPRIM7         BRANCH IF ALU2 HAD NO MORE DEP'S
00033C 6339        4060 INSDELAY BU    DEPRIM5               GO BACK AND LOOK FOR ONE OF THE ABOV

00033D 4828        4064 DEPRIM6  XFR   STATIMG,STAT          SET STATS TO HDWE
00033E 2B40        4067          BOC   STATB,DEPRIMA         BRANCH IF ALU2 FOUND DEV NOT BUSY
00033F 8502        4070          ORI   PNDSTS,UNITCHK        SET UNIT CHECK IN STATUS
000340 6322        4073 DEPRIMA  BU    CHKONA                GO RAISE REQ-IN             EC 732423

000341 2200        4077 DEPRIM7  BOC   ALUR,TROUBLE          BRANCH IF ALU2 ERROR
000342 2B48        4080          BOC   STATB,DOHOLDS         BRANCH IF A DEV BSY TO SET HOLD
000343 2368        4083 BMASKED  BOC   MIFTR,MIFTR0D         BRANCH IF MIS AVAILABLE           ***
000344 4021        4086 SETHOLDS XFR   CURCOMM,AR            MOVE CHAIN HOLD MASK TO ALU REG
000345 C100        4089          AND   CTIMAGE,0             AND OUT CHAIN HOLD BITS
000346 4150        4092          XFR   CTIMAGE,CTI           SET NEW CHAIN HOLD STATUS TO HDWE
000347 6513        4095 RUNALU   BU    ALUCHECK              GO DO ALU CHECK BEFORE RESCANNING

000348 2385        4099 DOHOLDS  BOC   MIFTR,MIFTR13         BRANCH IF MIS AVAILABLE
000349 8080        4102 MASKFORA ORI   CURCOMM,HOLDA         SET INTF A HOLD
00034A 6343        4105          BU    BMASKED               RETURN

                   4110 **************************** HIO NOT OPERATING ************************
                   4111 *THE HIONOP ROUTINE RETURNS THE CU TO IDLE STATUS IF HALT IO OCCURS    *
                   4112 *WITH NO OPERATION IN PROGRESS. THE TU IS RELEASED IF NO STS PNDC.     *
                   4113 ************************************************************************

00034B C804        4116 HIONOP   AND   STATIMG,SETSTATB      CLEAR STAT IMAGE REG
00034C C1E0        4119 HIONOP2  AND   CTIMAGE,HOLDINT+HOLDA+HOLDB CLEAR TAGS EXCEPT HOLDS
00034D C9FE        4122          AND   FLAGS,ONES-CHAIN      RESET CHAIN FLAG
00034E D986        4125          ANDM  FLAGS,STATPNDG+STACK+CONCON  MASK FOR PENDING STATUS
00034F 2053        4128          BOC   DBUS,HIONOP1          BRANCH IF NO STATUS TO DESELECT
000350 8120        4131          ORI    CTIMAGE,HOLDINT      RAISE HOLD INTF
000351 C400        4134          AND   WORK1,0               CLEAR WORK1
000352 62E5        4137          BU    CLEANUP               SKIP DESELECTING THE DEVICE

000353 62DE        4141 HIONOP1  BU    DODES1                  GO DESELECT THE DEVICE


                   4144 ************************************************************************
                   4145 **************************** HIO OPERATING ****************************
                   4146 *THE HIOPERG ROUTINE DROPS THE CU OFF LINE, FIRST RAISING CU BUSY TO  *
                   4147 *PROTECT ALU 1 FROM CHANNEL TRAP.                                      *
                   4148 ************************************************************************

000354 C9FE        4151 HIOPERG  AND   FLAGS,ONES-CHAIN      RESET THE CHAIN FLAG
000355 4828        4154          XFR   STATIMG,STAT          SET STOP IF APPLICABLE
000356 C1C0        4157          AND   CTIMAGE,HOLDA+HOLDB RESET ALL TAGS EXCEPT CHAIN HOLDS
000357 8130        416C          ORI   CTIMAGE,CUBUSY+HOLDINT MSET BUSY AND INTF HOLD
000358 4150        4163          XFR   CTIMAGE,CTI           DROP CHANNEL TAGS

000359 2859        4167 NOTYET   BOC   ADROUT,NOTYET         WAIT FOR ADDRESS OUT TO FALL
00035A 6294        4170          BU    SETSTOP               GO TO AWAIT ALU 2 COMPLETION
```

(Omitted Nonpertinent Coding)

```
                   4487 ***************************** BURST WAIT ******************************
                   4488 * BURST WAIT IS USED BY READ, WRITE, AND SENSE OPS TO WAIT FOR ALU2   *
                   4489 * FINISH.                                                             *
                   4490 * ADDRESS OUT WILL BE MONITORED FOR A HIO CONDITION AND IF HIO IS    *
                   4491 * GIVEN OP-IN WILL BE RESET AND THE OPERATION TERMINATED NORMALLY    *
                   4492 * DATA FLOW ERRORS,ALU2 ERRORS AND UNIT EXCEPTION CONDITION WILL BE  *
                   4493 * SET AS REQUIRED IN ENDING STATUS.                                   *
                   4494 ************************************************************************

0003B0 6294        4497 GOSTOP   BU    SETSTOP               GO SET STOP STAT
0003B1 5441        4500 LETSREAD XFR   XOUTBIM,XOUTB         KICK OFF READ OP
0003B2 8880        4503          ORI   STATIMG,STOP          SET STOP FOR LATER
0003B3 2854        4506 SVCWATE  BOC   ADROUT,HIOPERG        BRANCH IF HIO
0003B4 2DB7        4509          BOC   SVCOUT,BSTWAIT        BRANCH IF SERVICE IN OR OUT
0003B5 3BBB        4512          BOC   STATD,NOSVC           BRANCH IF NO SERVICE
0003B6 63B3        4515          BU    SVCWATE               GO BACK AND DO IT AGAIN

0003B7 2854        4519 BSTWAIT  BOC   ADROUT,HIOPERG        BRANCH IF HIO ISSUED
0003B8 29B0        4522          BOC   CMDOUT,GOSTOP         BRANCH IF CMD OUT IS UP
0003B9 3BBF        4525 BSTWAIT1 BOC   STATD,BSTDONE         BRANCH IF ALU2 COMPLETED
0003BA 63B7        4528          BU    BSTWAIT               GO BACK AND CHECK FOR FINISH
```

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0003BB 3ABF         4532 NOSVC     BOC   STATC,BSTDONE        BRANCH IF ALU HAD ERROR
0003BC 22DB         4535           BOC   ALUR,ALU2HDER        BRANCH IF ALU ERROR
0003BD 2BBF         4538           BOC   STATB,BSTDONE        BRANCH IF UNIT EXCP
0003BE 8709         4541           ORI   SNSSTS2,RDNOISE+DATACK  NOISE IN SENSE
0003BF 4828         4544 BSTDONE   XFR   STATIMG,STAT         SET STOP TO DATA FLOW
0003C0 22DB         4547           BOC   ALUR,ALU2HDER        BRANCH IF ALU2 HAD HDWE ERROR
0003C1 D00B         4550           ANDM  CURCOMM,X'0B'        MASK FOR SENSE TYPE COMMAND
0003C2 20D9         4553           BOC   DBUS,BSTWAIT2        BRANCH IF SO
0003C3 D001         4556           ANDM  CURCOMM,1            MASK FOR WRITE TYPE COMMAND
0003C4 37CF         4559           BOC   DREG7,CHEKB          BRANCH IF SO

0003C5 DC6C         4563           ANDM  SETDIA1,DMR+IBGMSR+RDACC+RDSTOP CHK DIAGNOSTIC BITS
0003C6 20CF         4566           BOC   DBUS,CHEKB           BRANCH IF OFF
0003C7 31D6         4569           BOC   DREG1,CHEKSNS        BRANCH IF IBG MSR
0003C8 32D6         4572           BOC   DREG2,CHEKSNS        BRANCH IF READ ACCESS

0003C9 4E88         4576           XFR   SETCNT1,XINB         OTHERWISE FETCH MODULO CNT FROM ALU2
0003CA 4421         4579           XFR   WORK1,AR             MOVE ALU1 MODULO TO ALU INPUT REG
0003CB EE00         4582           XO    SETCNT1,0            COMPARE BOTH MODULO COUNT
0003CC 20D6         4585           BOC   DBUS,CHEKSNS         BRANCH IF SAME
0003CD 8704         4588 HADOVERN  ORI   SNSSTS2,OVERUN       SET OVERUN BIT IN SENSE DATA
0003CE 63DC         4591           BU    SETUNTCK             GO SET EQUIP CHK

0003CF 2BDF         4595 CHEKB     BOC   STATB,ALU2UNEX       BRANCH IF ALU2 SIGNALLED UX

0003D0 DD80         4599 CHKUNCHK  ANDM  SETDIA2,BLKDC        MASK TO CHEK BLOCK DATA CHEK FLAG
0003D1 30D9         4602           BOC   DREG0,BSTWAIT2       BRANCH IF ON TO BYPESS
0003D2 28F0         4605           BOC   ADROUT,ENDHIO        BRANCH IF HIO
0003D3 3AE1         4608 CHKALU2   BOC   STATC,DATCHECK       BRANCH IF ALU2 SIGNALLED UC
0003D4 27E1         4611           BOC   DFLER,DATCHECK       BRANCH IF ANY DATA FLOW ERRORS

0003D5 3FCD         4615 CHKOVRN   BOC   OVERRUN,HADOVERN     GO SET EQUIP CHK IF OVERRUN
0003D6 9700         4619 CHEKSNS   ORM   SNSSTS2,0            MASK SENSE DATA FOR ERRORS
0003D7 20D9         4622           BOC   DBUS,BSTWAIT2        BRANCH IF NO ERRORS
0003D8 63DC         4625           BU    SETUNTCK             SENSE ERRORS--SET UNIT CHECK

0003D9 850C         4629 BSTWAIT2  ORI   PNDSTS,CHANEND+DEVEND POST CE AND DE IN STATUS
0003DA 63DD         4632           BU    SETPNDG              GO SET STS PENDING

0003DB 8710         4636 ALU2HDER  ORI   SNSSTS2,EQUIPCK      SET EQUIPMENT CHECK IN SENSE
0003DC 850E         4639 SETUNTCK  ORI   PNDSTS,CHANEND+DEVEND+UNITCHK SET CE,DE,AND UC IN STATUS
0003DD 8904         4642 SETPNDG   ORI   FLAGS,STATPNDG       SET STATUS PENDING FLAG
0003DE 6299         4645           BU    TERMSTAT             GO TO TERMINAL STATUS

0003DF 8501         4649 ALU2UNEX  ORI   PNDSTS,UNITEXC       SET UNIT EXEPTION IN STATUS
0003E0 63D0         4652           BU    CHKUNCHK             GO LOOK FOR UNIT CHECK

0003E1 D288         4656 DATCHECK  ANDM  XOUTAIM,RDRDB+CONTROL
0003E2 20E8         4659           BOC   DBUS,SKIPNOIS        BRANCH IF NOT A READ OP
0003E3 30E8         4662           BOC   DREG0,SKIPNOIS       BRANCH IF READ CONTROL CMD
0003E4 F00C         4665           XOM   CURCOMM,X'0C'        IS THIS A RDB OP
0003E5 20ED         4668           BOC   DBUS,ISLDPT          BR IF SO

0003E6 4490         4672 FTCHNOIS  XFR   WORK1,XINA           FETCH NOISE BIT IF APPLICABLE
0003E7 4421         4675           XFR   WORK1,AR             MOVE TO ALU INPUT REG

0003E8 27EB         4679 SKIPNOIS  BOC   DFLER,DODATCK        BRANCH IF DATA FLOW ERROR    EC 732423
0003E9 8700         4682           ORI   SNSSTS2,0            OTHERWISE SET NOISE ONLY     EC 732423
0003EA 63DC         4685           BU    SETUNTCK             GO SET UNIT CHECK            EC 732423
0003EB 8708         4688 DODATCK   ORI   SNSSTS2,DATACK       SET NOISE AND DATA CHECK     EC 732423
0003EC 63DC         4691           BU    SETUNTCK             GO SET UNIT CHECK            EC 732423
0003ED D410         4694 ISLDPT    ANDM  WORK1,BOT            IS LOAD POINT ON
0003EE 20E6         4697           BOC   DBUS,FTCHNOIS        BR IF NOT
0003EF 63E8         4700           BU    SKIPNOIS             SKIP NOISE THIS TIME

0003F0 E111         4704 ENDHIO    XO    CTIMAGE,OPIN+CUBUSY  RESET OP IN RAZE CUB
0003F1 4150         4707           XFR   CTIMAGE,CTI          SET TO HARDWARE
0003F2 63D3         4710           BU    CHKALU2              RETURN TO CHECK UNIT CHK COND

                    4715 ***************************** COMMAND REJECT ****************************
                    4716 *  COMMAND REJECT IS ENTERED AFTER OPENERS AND IF AN INVALID OP CODE  *
                    4717 * WAS RECEIVED AT CMD OUT TIME. SENSE DATA WILL BE RESET AND CMD RJCT *
                    4718 * SENSE SET UP. THIS ROUTINE WILL NOT BE ENTERED IF OPENERS FINDS ANY *
                    4719 * PENDING STATUS.                                                     *
                    4720 ***********************************************************************

0003F3 140F         4723 COMFEJC1  STO   XOUTBIM,NDXSNSR-ALU2BRT FETCH ALU2 SENSE RESET INDEX
0003F4 5441         4726           XFR   XOUTBIM,XOUTB        KICK OFF ALU2
0003F5 8801         4729           ORI   STATIMG,SETSTATD     SET STATD TO INDICATE SNS RESET
0003F6 4828         4732           XFR   STATIMG,STAT         SET TO HARDWARE
0003F7 0700         4735           STO   SNSSTS2,0            CLEAR SENSE REG 2
0003F8 4012         4738           XFR   CLEAR                RESET DATA FLOW ERRORS
0003F9 8780         4741           ORI   SNSSTS2,CMDREJ       POST CMD REJECT
0003FA 0502         4744           STO   PNDSTS,UNITCHK       POST UNIT CHECK
0003FB 8904         4747           ORI   FLAGS,STATPNDG       POST STATUS PENDING
0003FC 60C0         4750           BU    PENDLINK
0003FD 2298         4753 BLOWOUT1  BOC   ALUR,HRDRST          BRANCH IF ALU ERROR          EC 732421
0003FE 0700         4756           STO   SNSSTS2,0            OTHERWISE CLEAR SENSE        EC 732421
0003FF 6398         4759           BU    HRDRST               RETURN                       EC 732421
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(Omitted Nonpertinent Coding)

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                    6060 *************************** SET DIAGNOSE CMD **************************
                    6061 * DOSETDIA WILL FETCH FOUR BYTES FROM THE CHANNELAND SAVE THEM FOR     *
                    6062 * USE LATER. THE FIRST BYTE WILL BE PASSED TO ALU2 AND IF THE FORCE    *
                    6063 * ALU ERRORS FLAG IS ON. IF THE GDT FLAG IS ON ALU1 WILL TIME OUT THE *
                    6064 * TIME SPECIFED IN THE LAST TWO BYTES. THIS ROUTINE IS ENTERED WHEN    *
                    6065 * THW CHANNEL ISSUES A SET DIAGNOSE COMMAND                            *
                    6066 **********************************************************************

000578 4CA0         6069 DOSETDIA XFR   SETDIA1,CBO        FETCH FIRST BYTE
000579 140E         6072          STO   XOUTBIM,NDXFLAGS-ALU2BRT LOAD ALU2 INDEX
00057A 4C42         6075          XFR   SETDIA1,XOUTA      PASS 1ST BYTE TO ALU2
00057B 5441         6078          XFR   XOUTBIM,XOUTB      TRAP ALU2 TO FETCH BYTE
00057C 1002         6081          STO   LINK1,BRETURN4     SET BYTE RECEIVED RETURN
00057D 1194         6084          STO   LINK2,SETSTOP      SET STOP RETURN
00057E 1283         6087          STO   LINK3,WRTHIO       SET HIO RETURN
00057F 1386         6090          STO   LINK4,SAV1FCH2     SET ROUTINE LINK
                    6092 **********************************************************************
                    6093 *GOFFTCH RESETS SERVICE IN FROM THE LAST BYTE FETCH AND LINKS TO      *
                    6094 *THE SERVICE SUBROUTINE                                               *
                    6095 **********************************************************************
000580 4150         6097 GOFETCH  XFR   CTIMAGE,CTI        DROP SERVICE IN
000581 620A         6100          BU    SERVRTN            GO GET NEXT BYTE
                    6103 **********************************************************************
                    6104 *DIALINK IS THE COMMON RETURN FROM THE SERVICE ROUTINE. LINK REG 4    *
                    6105 *WILL BE LOADED TO RETURN TO THE APPROPRIATE BYTE FETCH               *
                    6106 **********************************************************************

000582 2484         6109 DIALINK  BOC   BOPE,SETBOPE       BRANCH IF BUS OUT PARITY BAD
000583 5322         6112          XFR   LINK4,IC           RETURN TO BYTE FETCH
000584 8720         6115 SETBOPE  ORI   SNSSTS2,BUSOC      SET BUS OUT CHECK
000585 5322         6118          XFR   LINK4,IC

                    6121 *** SAVE BYTE 1--FETCH BYTE 2
000586 4DA0         6123 SAV1FCH2 XFR   SETDIA2,CBO        GO GET BYTE 1
000587 1389         6126          STO   LINK4,SAV2FCH3     POINT TO NEXT FETCH
000588 6580         6129          BU    GOFETC"            GO GET EM

                    6132 *** SAVE BYTE2--FETCH BYTE 3
000589 4EA0         6134 SAV2FCH3 XFR   SETCNT1,CBO        GO GET BYTE 2
00058A 1410         6137          STO   XOUTBIM,NDXFLAG2-ALU2BRT
00058B 4E42         6140          XFR   SETCNT1,XOUTA      MOVE FLAGS TO XOUTA
00058C 5441         6143          XFR   XOUTBIM,XOUTB      KICK OFF ALU2 TO FETCH FLAGS
00058D 138F         6146          STO   LINK4,SAV3NOFC     POINT TO NEXT SAVE--NOFETCH
00058E 6580         6149          BU    GOFETCH            GO GET EM

                    6152 *** SAVE BYTE 3 DROP SERVICE IN
00058F 4FA0         6154 SAV3NOFC XFR   SETCNT2,CBO        GO GET BYTE 3
000590 4150         6157          XFR   CTIMAGE,CTI        DROP SERVICE IN

                    6160 ***LOOK FOR GDT FLAG AND, IF ON, TIME OUT PRIOR TO PRESENTING STATUS
000591 DC10         6162          ANDM  SETDIA1,GDT        MASK TO CHECK GO DOWN TIME FLAG
000592 209D         6165 PRSNTSTS BOC   DBUS,GIVSTS        BRANCH IF OFF
000593 0400         6168          STO   WORK1,0            CLEAR WORK REG(LOWEST CNTR)
000594 A401         6171 INCAGN   ADD   WORK1,1            BUMP LOWEST COUNTER (400 NANOSECS)
000595 289E         6174          BOC   ADROUT,GDTHIO      HIO IF UP
000596 2194         6177          BOC   NALCO,INCAGN       BRANCH IF NO CARRY TO BUMP AGAIN
000597 AFFF         6180          ADD   SETCNT2,ONES       DECREMENT LO CNTR (103.150 USECS)
000598 219A         6183          BOC   NALCO,DECHICNT     BRANCH IF NO CARRY TO DECR HI CNTR
000599 6594         6186          BU    INCAGN             OTHERWISE, GO BUMP LOWEST AGAIN
00059A AEFF         6189 DECHICNT ADD   SETCNT1,ONES       DECREMENT HI CNTR (27 MSECS)
00059B 219D         6192          BOC   NALCO,GIVSTS       GET OUT IF NO CARRY (PRESENT STATUS)
00059C 6594         6195          BU    INCAGN             OTHERWISE GO DO IT ALL AGAIN
00059D 63D6         6198 GIVSTS   BU    CHEKSNS            GO ASSEMBLE ENDING STATUS
00059E 6354         6201 GDTHIO   BU    HIOPERG            GET OUT HIO ISSUED


00059F 6203         6205 WRTINIT  BU    WRTBGN             RETURN TO WRITE ROUTINE
0005A0 63B1         6208 DOAREAD  BU    LETSREAD           GO START READ OP


                    6211 **********************************************************************
                    6212 * CLEANGO OCCURS WHEN CLEAN INITIAL STATUS IS ACCEPTED
                    6213 **********************************************************************

0005A1 4150         6216 CLEANGO  XFR   CTIMAGE,CTI        DROP STATUS IN
0005A2 4242         6219          XFR   XOUTAIM,XOUTA      SET DATA FLOW MASK TO HDWE
0005A3 4828         6222          XFR   STATIMG,STAT       RESET STAT D IF ON
0005A4 289F         6225 SVCOUP   BOC   ADROUT,WRTINIT     BRANCH IF HIO
0005A5 2DA4         6228          BOC   SVCOUT,SVCOUP      WAIT FOR SERVICE OUT TO DROP
0005A6 9000         6231          ORM   CURCOMM,0          MASK FOR BRANCHING
0005A7 379F         6234          BOC   DREG7,WRTINIT      BRANCH IF WRITE OR TIE REQUEST
```

(Omitted Nonpertinent Coding)

MPUY (ALU-2) PARTIAL MICROCODE LISTING

```
  LOC  OBJECT      STMT   SOURCE STATEMENT
000000  CODE        837+BEGIN    CSECT
```

```
                    839 ALU2TBLE VECT1
                    840+************************************************************
                    841+********************** ALU2 ROS ENTRY BRANCH TABLE ****************
                    842+************************************************************
                    843+*   ALU2 IS ALWAYS SLAVED TO ALU1. ANY OPERATION EXECUTED BY ALU2      *
                    844+*   MUST ALWAY BE INITIATED BY ALU1 VIA A XOUTB. THE XOUTB BY ALU1     *
                    845+*   TRAPS ALU2 TO LOCATION 000. ALU2,BEGINNING EXECUTION AT 000,       *
                    846+*   FETCHES AN INDEX BYTE FROM ALU1 AND MOVES IT TO THE INSTRUCTION    *
                    847+*   COUNTER. THE INDEX BYTE WILL POINT TO ONE OF THE BRANCH INSTRUCT-  *
                    848+*   IONS IN THE BRANCH TABLE. THE SELECTED BRANCH INST WILL BE         *
                    849+*   EXECUTED AND THE DESIRED ROUTINE WILL BE ENTERED. WHEN THE         *
                    850+*   SELECTED ROUTINE COMPLETES, STAT D WILL BE SET INDICATING TO       *
                    851+*   ALU1 THAT THE DESIRED FUNCTION HAS BEEN COMPLETED. ALU2 WILL THEN  *
                    852+*   BE HELD AT LOCATION 000 UNTIL ACTUATED BY ALU1 VIA XOUTB TRAP      *
                    853+************************************************************

000000 4188         856 BYPASS    XFR   WORK2,XINB          FETCH ALU1 INDEX
000001 0400         859           STO   STATIMG,ZERO        CLEAR STAT IMAGE REG
000002 1400         862           STOH  STATIMG,0            CLEAR STAT IMAGE REC HIGH
000003 4428         865           XFR   STATIMG,STAT        CLEAR ANY OUTSTANDING STATS
000004 4122         868           XFR   WORK2,IC            MOVE INDEX TO INST CTR
000005 655B         871 NDXTST3   BU    EXECTST3            GO DO ALU 2 CHECKOUT
000006 61AC         874 NDXDES    BU    EXECDES             HIO NOT OPRTING--GO DESELECT TU
000007 634D         877 NDXPOLL   BU    EXECPOLL            GO POLL DEVICE FOR STATUS
000008 6193         880 NDXGRST   BU    EXECGRST            GO DO GENERAL RESET
000009 6199         883 NDXSRST   BU    EXECSRST            GO DO SELECTIVE RESET
00000A 61EC         886 NDXSDE    BU    EXECSDE             GO SET DEVICE END
00000B 61BC         889 NDXABRT   BU    EXECABRT            GO STOP THE DEVICE IF GOING
00000C 6529         892 NDXDMR    BU    EXECDMR              GO DO DIAG MEASERE
00000D 6553         895 NDXAXESS  BU    ACCESS              GO GET READ ACCESS TIME
00000E 4590         898 NDXFLAGS  XFR   FLAGS,XINA          BRING IN FLAG BYTE
00000F              900+NDXSNSR   EQU   *
00000F 619B         902 SRETURN7  BU    ZAPIM           USE ON SENSE RESET & SEL RESET RETURN
000010 5590         905 NDXFLAG2  XFR   WORK5,XINA          GET TUBO MASK (SET FLAGS #3)
000035              907+NDXFSF    EQU   X'35' .             GO DO FORWARD SPACE FILE
000031              908+NDXERS    EQU   X'31' .             GO DO ERASE TO END OF TAPE(EOT)
000037              909+NDXFSR    EQU   X'37' .             GO DO FORWARD SPACE RECORD
000033              910+NDXRDF    EQU   X'33' .             GO DO READ FORWARD
00003C              911+NDXBSF    EQU   X'3C' .             GO DO BACKSPACE FILE
00003E              912+NDXBSR    EQU   X'3E' .             GO DO BACKSPACE RECORD
00003A              913+NDXRDB    EQU   X'3A' .             GO DO READ BACKWARD
000013              914+NDXWRT    EQU   X'13' .             GO DO WRITE OPERATION
000020              915+NDXWTM    EQU   X'20' .             GO DO WRITE TAPE MARK
000022              916+NDXERG    EQU   X'22' .             GO 40 ERASE RECORD GAP
00002F              917+NDXRWD    EQU   X'2F' .             GO DO REWIND
000029              918+NDXRWU    EQU   X'29' .             GO DO REWIND UNLOAD
0000ED              919+NDXSTS    EQU   X'ED' .             GO DO INITIAL STATUS
0000E1              920+NDXSNS    EQU   X'E1' .             GO DO SENSE OP
000011 0401         923 SETDLONE  STO   STATIMG,SETSTATD    TURN ON STATD
000012 4428         926           XFR   STATIMG,STAT        AND STOP

                    929 **************************** WRITE ROUTINE ****************************
                    930 *  INITIAL ENTRY ON WRITE COMMANDS EITHER PE, NRZI OR LWR EITHER        *
                    931 *  DENSITY. THE COMMAND IS SET IN REGISTER WORK4 AND REGISTER LINK1     *
                    932 *  CONTAINS THE ADDRESS OF THE ENTRY TO THE WRITE ROUTINE IN 'PAGE 2'  *
                    933 *  PART OF THIS ROUTINE IS SHARED BY WTM AND ERG ROUTINES              *
                    934 ************************************************************************

000013 0800         937 EXECWRT   STO   TRACER,ZERO         SET IDENTITY
000014 0308         940 SETUP     STO   WORK4,WRITE         SET WRITE COMMAND
000015 1C01         943           STO   LINK1,WRTSTR        SET RETURN ENTRY
000016 3A18         946 TESTLWR   BOC   STATC,SETLPCMD      BR IF LWR OR LWTM
000017 613C         949           BU    TRNARND             BR TO TURNAROUND

                    952 ************************************************************************
                    953 *  STATC ON FROM ALU1 INDICATES A LWR OR LWTM.                          *
                    954 *  THE COMMAND IS SET TO ALLOW TURN-AROUND ROUTINE TO PROCESS THE       *
                    955 *  COMMAND AND SET DATA FLOW MASKS. THERE WILL NOT BE ANY TURNAROUND    *
                    956 *  DELAYS TAKEN.
                    957 ************************************************************************

000018              959 SETLPCMD  EQU   *
000018 0328         961 WRSTALP   STO   WORK4,WRITE+SETDIAG   SET WRITE AND DIAG CMD
000019 C6EF         964           AND   SENSE1,ONES-BOT     TURN OFF BOT IF ON
00001A 341D         967           BOC   WRTSTAT,GOTURN      BR WRITE STATUS
00001B 301E         970           BOC   BACKWD,RDBKLP       BR BACKWARD STATUS
00001C 0360         973           STO   WORK4,RDFWDD+SETDIAG  SET READ FWD AND DIAG CMD
00001D 613C         976 GOTURN    BU    TPNARND             GO TO TURNAROUND
00001E 03A0         979 RDBKLP    STO   WORK4,RDBKWD+SETDIAG  SET READ BKWD AND DIAG CMD
00001F 613C         982           BU    TRNARND             GO TO TURNAROUND

                    985 ************************* WRITE TAPE MARK ROUTINE *************************
                    986 *  INITIAL ENTRY ON WRITE TAPE MARK COMMAND EITHER PE, NRZI             *
                    987 *  OR LOOP WRITE TAPE MARK.                                             *
                    988 *  THE WTM TRACE BIT IS SET ON IN TRACER REGISTER AND THEN              *
                    989 *  A BRANCH IS MADE TO SHARE THE REST OF THE SET UP WITH                *
                    990 *  THE WRITE ROUTINE.                                                   *
                    991 ************************************************************************
000020 0802         993 EXECWTM   STO   TRACER,WTMOP        SET ROUTINE IDENTITY
000021 6014         996           BU    SETUP               GO GET GOING
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```
                  ***************************** ERASE RECORD GAP ****************************
                  *  INITIAL ENTRY FOR ERASE GAP OP. THE REG TRACE BIT IS SET                  *
                  *  IN THE TRACER REGISTER AND A BRANCH MADE TO SHARE THE REST OF THE         *
                  *  SETUP WITH THE WRITE ROUTINE.                                            *
                  *  AFTER VELOCITY IS ATTAINED A RETURN WILL BE MADE TO 'ERGSIR'             *
                  *  (PE) OR 'SETERGF' (NRZI) AT WHICH TIME THE COUNT AND FLAGS               *
                  *  WILL BE SET TO COMPLETE THE ERASE OP. THE TAPE WILL BE ERASED FOR        *
                  *  APPROX. 4.2 IN.                                                          *
                  *  THE TAK ROUTINE WILL DO THE COUNTING OF TACH PULSES AND ALSO             *
                  *  MONITER THE TU BUS IN TO ASSURE NO DATA IS PRESENT. IF ANY DATA          *
                  *  IS DETECTED THEN NOISE ERROR WILL BE SET.                                *
                  *                                                                           *
                  *  THERE ARE 106 TACH PULSES PER IN.                                        *
                  ******************************************************************************
000022 0804       EXECERG  STO   TRACER,ERGOP          SET ERASE GAP OPERATION FLAG
000023 6014                BU    SETUP                  GO CONTINUE SET UP

000024 19ED       ERGSIR   STO   LINK2,GOENDUP         SET UP RETURN TO ENDUP
000025 01B4       ERGCTR   STO   WORK2,ONES-75         SET COUNT FOR 336
000026 00FE                STO   WORK1,ONES-1          TAC COUNTS
000027 8810       SETERGF  ORI   TRACER,ERGFLAG        SET FLAG TO CHECK FOR ERROR
000028 62CA                BU    TAKS                  GO TO TAK RTN

                  ******************* REWIND OR REWIND UNLOAD *************************

                  *  REWIND, REWIND UNLOAD AND DATA SECURITY ERASE SHARE A                   *
                  *  COMMON ROUTINE. THE ENTRY POINTS VARY SO THE COMMAND                    *
                  *  CAN BE SET IN WORK4. REWIND UNLOAD WILL SET STAT C ON                   *
                  *  THEN STAT A IS SET TO IDENTIFY THESE THREE COMMANDS TO                  *
                  *  TURNAROUND ROUTINE AND TO ENDUP ROUTINE.                                *
                  *****************************************************************************
000029 0380       EXECRWU  STO   WORK4,RUN             LOAD REWIND UNLOAD CMD
00002A 8402                ORI   STATIMG,SETSTATC       FLAG UNIT CHK
00002B 1CC1       LKREWRUN STO   LINK1,ENDUP           SET RETURN ADDRESS AFTER CMD EXEC
00002C 8408       CTRLSETA ORI   STATIMG,SETSTATA      SET STATA ON TO
00002D 4428                XFR   STATIMG,STAT           INDICATE REW, RUN OR DSE
00002E 613C       SCOOT    BU    TRNARND               GO TO TURNA ROUND


00002F 0301       EXECRWD  STO   WORK4,REWIND          LOAD REW CMD
000030 602B                BU    LKREWRUN              GO SET LINKAGE REG & STAT A

                  ********************** DATA SECURITY ERASE ***********************
                  *  INITIAL ENTRY FOR DATA SECURITY ERASE OP.                              *
                  *  THE COMMAND IS SET IN WORK 4 REGISTER AND A BRANCH IS                  *
                  *  MADE TO SHARE THE SETUP WITH REWIND AND REWIND                         *
                  *  IF ALL TESTS ARE OK. THE DRIVE WILL THEN CONTINUE TO ERASE             *
                  *  TO END OF TAPE.                                                        *
                  ****************************************************************************

000031 0304       EXECDSE  STO   WORK4,ERGTOTI         PUT CMD IN LSR
000032 602B                BU    LKREWRUN              GO SET STATA ON
                  *                      ***  ***  **** *  *    *  * ***                  *
                  *                      * *  *    *  * *  *    *  * *                    *
                  *                      *  * **** *  * * ***    ** *                     *
                  ***********READ OPERATION  INPUT BRANCH TABLE************************
                  *                                                                       *
                  * DEPENDING ON THE TYPE OF OPERATION- ONE OF THE SIX INPUT LEGS WILL   *
                  * BE SELECTED. EACH LEG  STORES AN APPROPRIATE TRACER ( NOT CE TRACE )*
                  * TO ENABLE THE MICROPROGRAM TO KEEP TABS ON WHAT IT IS DOING..THE SIX*
                  * INPUT LEGS AND THE TRACERS THEY SET ARE;                              *
                  *             1.     READ BACKWARD         TRACER 6                     *
                  *             2.     READ FORWARD          TRACER 6                     *
                  *             3.     BACKSPACE FILE        TRACER 5                     *
                  *             4.     FORWARD SPACE FILE    TRACER 5                     *
                  *             5.     BACKSPACE RECORD      TRACER 7                     *
                  *             6.     FORWARDSPACE RECORD TRACER 7                       *
                  *                                                                       *
                  *              TRACE REG                                                *
                  *              0 CREASER                                                *
                  *               1 BOR TRACE                                             *
                  *                2 REW OP                                               *
                  *                 3 IBGTRACE                                            *
                  *                  4 TACH TRACE                                         *
                  *                   5 FILE OP                                           *
                  *                    6 READ OP                                          *
                  *                     7 SPACE OP                                        *
                  *************************************************************************

000033 0802       EXECRDF  STO   TRACER,READOP         TURN ON THE READ TRACER
000034 6038                BU    SETFWD
000035 0804       EXECFSF  STO   TRACER,X'04'           TURN ON FILE TRACER
000036 6038                BU    SETFWD
000037 0801       EXECFSR  STO   TRACER,SPACEOP        TURN ON SPACE TRACER
                  *************************************************************************
                  * NOW THAT THE OP TRACERS ARE STORED, PUT THE PROPER READ  COMMAND      *
                  * IN WORK4 AND BRANCH TO START TAPE MOTION.                             *
                  *************************************************************************

000038 0340       SETFWD   STO   WORK4,RDFWDD           SET RD FWD TO LSR
000039 6040                BU    CHGDIREC              ALL SET,GO AHEAD

00003A 0802       EXECRDB  STO   TRACER,READOP          TRN ON READ TRACER
00003B 603F                BU    SETBKWD
00003C 0804       EXECBSF  STO   TRACER,FILEOP          TRN ON THE FILE TRACER
```

```
00003D 603F   1159               BU     SETBKWD                 TRN ON THE SPACE TRACER
00003E 0801   1162 EXECBSR       STO    TRACER,SPACEOP          SET RD BKWD TO LSR
00003F 0380   1165 SETBKWD       STO    WORK4,RDBKWD           SET UP RETURN REG
000040 1CC4   1168 CHGDIREC      STO    LINK1,TRETRD            AND BR TO TURNAOUND
000041 613C   1171               BU     TRNARND
              1174 ******************************************************************
              1175 * THIS IS THE RETURN POINT FROM TURNAROUND ROUTINE.  AT THIS POINT  *
              1176 * THE TAPE UNIT HAS ACCEPTED THE READ COMMAND AND IS UP TO SPEED.  *
              1177 *                                                                  *
              1178 ******************************************************************

              1181 STARTAPE ORM     SENSE1,0                SEE IF BOT IS ON
000042 9600   1184          BOC     DREG3,LPBURST         - BR IF IT IS
000043 334A   1187          ORM     SENSE2,0               GET SNS TO DBUS FOR TEST
000044 9700   1190          BOC     NOTPE,ISNRZI2          BR IF NRZI UNIT
000045 3347   1193          BU      READTAPE               NO BOT, LOOK FOR DATA
000046 605E   1196 ISNRZI2  BOC     NRZFEAT,ISNRZI         BR IF NRZI FEATURE IS INSTALLED
000047 2303
              1199 *                ***** SET NOT CAPABLE *****

              1202 NOTCOMP  STO     MPGMERR,NOTCAP         SET NOT CAPABLE
000048 1801   1205 GOEND    BU      CLRXOUTA               STOP
000049 61C0
              1209 ******************************************************************
              1210 *      READ  FROM  LOAD  POINT                                     *
              1211 ******************************************************************
              1212 * TAPE MOTION STARTED AT LOAD POINT--SO LOOK FOR LOAD POINT BURST. IF *
              1213 * NONE,OR NOT LONG ENOUGH, SET NRZI MODE TO DATA FLOW.  IF NO NRZI   *
              1214 * FEATURE,SET NOT CAPABLE.                                          *
              1215 ******************************************************************

              1218 LPBURST  STO     WORK1,X'FE'            SET UP TO MOVE TAPE
00004A 00FE   1221          STO     WORK2,X'D4'              THREE INCHES
00004B 01D4   1224          STO     LINK2,TRETURN1         SET UP RETURN REG  (READLP)
00004C 19F1   1227 CRETEST  BU      ZEROCTR                GO CT 300 TACH PULSES
00004D 62CA

              1230 ******************************************************************
              1231 * ON RETURN FROM TACH ROUTNE,WE WILL INTERROGATE THE PTE BRANCH      *
              1232 * CONDITION FOR 1792 BIT CELLS. OF THIS 512 BIT CELLS MUST BE PTE TO *
              1233 * ALLOW THE READ TO PROCEED IN PE MODE.  MORE THAN 1280 BIT CELLS OF *
              1234 * NO PTE WILL DROP US OUT OF OUR COUNT LOOP AND ATTEMPT SET OF 800   *
              1235 * BPI.  BASICALLY,THIS ROUTINE CONSISTS OF TWO COUNTERS (EACH SPANS 2 *
              1236 * LSR) WHICH VIE FOR INCREMENTATION.  THE FIRST TO OVERFLOW DETER-   *
              1237 * MINES  THE OPERATING MODE.                                        *
              1238 ******************************************************************

              1241 READLP    STO    FRU,ONES-1             CNT IS 512 BIT CELLS
00004E 09FE   1244           STO    WORK4,ONES-4           CNT IS 1280 BIT CELLS
00004F 03FB
              1248 OKALREDY  BOC    RDTIME,OKALREDY        WAIT FOR READ TIME TO FALL
000050 2450   1251           BOC    PTE,COUNTLPB           BR IF PTE IS ON
000051 2C5A   1254           ADD    WORK1,1                BUMP CTR BY ONE
000052 A001   1257           BOC    NALCO,WAITACEL
000053 2158   1260           ADD    WORK4,1                BUMP CTR BY ONE
000054 A301   1263           BOC    NALCO,WAITACEL         BR IF NO OVERFLOW
000055 2158   1266           BOC    NRZFEAT,SET800         GO SET NRZI
000056 23BA   1269           BU     NOTCOMP                NRZI NOT INSTALLED- SET NOT CAPABLE
000057 6048   1272 WAITACEL  BOC    RDTIME,OKALREDY        WAIT FOR READTIME
000058 2450   1275           BU     WAITACEL                 TO BECOME ACTIVE
000059 6058
              1279 COUNTLPB  ADD    WORK2,1                BUMP CTR BY ONE
00005A A101   1282           BOC    NALCO,WAITACEL         BR IF NO OVERFLOW
00005B 2158   1285           ADD    FRU,1                  BUMP CTR BY ONE
00005C A901   1288           BOC    NALCO,WAITACEL         BR IF NO OVERFLOW
00005D 2158
              1292 ******************************************************************
              1293 *            PE  READ  --  NOT LOAD POINT                          *
              1294 ******************************************************************
              1295 * THIS IS THE ENTRY POINT IF BOT IS NOT ON IN TU SENSE    BYTE 0.  *
              1296 * HERE WE CYCLE  UNTIL A BOR,TU INTERRUPT,TAPE MARK OR IBG DROPS US *
              1297 * OUT OF THE LOOP. A TM WILL NOT DROP US OUT  OF THE LOOP UNTIL WE *
              1298 * ARE SATISFIED THAT IT IT A TRUE TAPE MARK (20 CELLS OF TM BOC).  *
              1299 ******************************************************************

              1302 READTAPE  ORI    STATIMG,PERMRDWT       SET READ CONDITION
00005E 8440   1305           XFR    STATIMG,STAT            TO DATA FLOW
00005F 4428   1308           STOH   WORK1,X'C0'            SET GATES FOR READ DET 10 PER CT
000060 10C0   1311           XFRH   WORK1,TUBO              ON RECORD SPACE OR FILE OP
000061 5060   1314           STO    WORK2,1                SET NOISE BIT FOR ALU1
000062 0101   1317 SETUXCNT  STO    WORK1,ONES-19          SET CNT FOR 20 BIT CELLS
000063 00EC   1320           STO    FRU,ONES-5             SET  NOISE RECORD BYPASS
000064 09FA   1323 CHKCLOCK  BOC    RDTIME,CHKBOR          WAIT FOR READTIME
000065 2467   1326           BU     CHKCLOCK                 TO RISE
000066 6065   1329 CHKBOR    BOC    BOR,TRACEBOR           BR ON BOR
000067 2E72   1332 CHKINTPT  BOC    DEVATTN,ABORTRD       BR ON TU INTERRUPT
000068 3FB4   1335           BOC    TM,TMCONFIG            BR IF TAPE MARK DET
000069 3D8D   1338 CHKIBG    BOC    IBG,IBGYES1           BR IF IBG IS ON
00006A 2F93   1341           BOC    BLOCK,BLOCKCHK          BR ON DATA DETECTED
00006B 3C6E   1344 CLOKWAIT  BOC    RDTIME,CLOKWAIT        WAIT FOR READTIME
00006C 246C   1347           BU     CHKCLOCK                 TO FALL
00006D 6065

              1351 BLOCKCHK  ADD    FRU,1                   BUMP BYPASS CNT BY 1
00006E A901   1354           BOC    NALCO,CLOKWAIT         RETURN ON NO CARRY
00006F 216C   1357           ORI    TRACER,IBGMARK         TURN ON IBGTRACE
000070 8810   1360           BU     CLOKWAIT                RETURN
000071 606C
```

```
                  1365 ***********************************************************************
                  1366 * A BOR DETECTED WILL GET US HERE , BUT IF WE  ARE  NOT A READ OP      *
                  1367 * WE WILL RETURN TO THE ORIGINAL LOOP.                                *
                  1368 ***********************************************************************
000072 8840       1370 TRACEBOR ORI   TRACER,BORMARK        TURN ON BOR TRACE BIT
000073 3679       1373          BOC   READOP,READYES        BR IF A READ OP
000074 6068       1376          BU    CHKINTPT              GO BACK TO STARTING LOOP

                  1381 ***********************************************************************
                  1382 * WE ARE NOW A READ OP SO COUNT 16 BIT CELLS- THEN DROP FORCE AND      *
                  1383 * NOT ALLOW ENVELOPE LOSS TO THE DATA FLOW,ALSO SET READ CONDITION.    *
                  1384 ***********************************************************************

000075 2FB0       1387 TRYAGAIN BOC   IBG,SETRDCHK          ABEND IF IBG
000076 3FB3       1390          BOC   DEVATTN,SETNOISE      ABEND IF TU DEV END
000077 2475       1393          BOC   RDTIME,TRYAGAIN       WAIT FOR RD TIME TO FALL
000078 607B       1396          BU    CNTABIT               GO COUNT AGAIN   IT

000079            1399 READYES  EQU   *                     RESET LINES
000079 4460       1401          XFR   STATIMG,TUBO            FOR DETECTION CONTROL
00007A 09F0       1404          STO   FRU,ONES-15           SET CNT FOR 16 BIT CELLS

00007B 247D       1408 CNTABIT  BOC   RDTIME,CNTABIT2       WAIT FOR READTIME TO RISE
00007C 607B       1411          BU    CNTABIT
00007D A901       1414 CNTABIT2 ADD   FRU,1                 BUMP CTR BY 1
00007E 2175       1417          BOC   NALCO,TRYAGAIN        TEST FOR CTR 16

00007F            1420 COUNT16  EQU   *
00007F 8D28       1422          ORI   XOUTAIM,FORCE+NOLOSS TRN ON FORCE & NOT ALLOW
000080 4D42       1425          XFR   XOUTAIM,XOUTA         SET FORCE TO XOUTA

                  1428 *        ONE BIT CELL FOR 200/IN/SEC = 3125 NANO SECS

                  1430 ***********************************************************************
                  1431 * WE HAVE NOW UNBLOCKED THE DATA FLOW READ CIRCUITS,SO     WE WILL      *
                  1432 * CYCLE LOOKING FOR IBG,DATA READY OR INTERRUPT       . DATA READY IS
                  1433 * IS THE PROPER EXIT. ALL OTHERS WILL SET UNIT CHECK.                  *
                  1434 ***********************************************************************
000081 2484       1437 FORCEON  BOC   RDTIME,COUNTPRE       WAIT
000082 2D9A       1440          BOC   DATARDY,PREAMBOK        FOR ERADTIME
000083 6081       1443          BU    FORCEON                   TO RISE
000084 A906       1447 COUNTPRE ADD   FRU,6                 BUMP TIME OUT COUNT
000085 2188       1450          BOC   NALCO,CKDTARDY          WHILE WAITING FOR BEG ONES
                  1452 * TIME OUT EQUALS 40 BIT CELLS WITHOUT SEEING BEGINNING ONES
000086 5060       1454          XFRH  WORK1,TUBO            RAISE READ DET LEV TO 10 PER CENT
000087 6080       1457          BU    SETRDCHK              GO SET START READ CHK
000088 2FB0       1460 CKDTARDY BOC   IBG,SETRDCHK          BR IF IBG IS ON
000089 3FB3       1463          BOC   DEVATTN,SETNOISE      BR IF TU INTERRUPT IS ON
00008A 2D9A       1466          BOC   DATARDY,PREAMBOK      WE WANT TO BR HERE ON DATA RDY
00008B 2488       1469          BOC   RDTIME,CKDTARDY       WAIT FOR READ TIME TI FALL
00008C 6081       1472          BU :  FORCEON

                  1475 ***********************************************************************
                  1476 * POSSIBLE TM CONFIGURATION.BUMP A COUNTER AMD RETURN.WHEN COUNT       *
                  1477 * GETS LARGE ENOUGH, CALL IT A TM AND GO WAIT FOR IBG                  *
                  1478 * 20 BIT CELLS OF TM BOC NEEDED TO RECOGNIZE A TAPE MARK.              *
                  1479 * THESE 20 BIT CELLS DO NOT HAVE TO BE CONTIGUOUS.                     *
                  1480 ***********************************************************************
00008D A001       1482 TMCONFIG ADD   WORK1,1               BUMP UEX CNT BY ONR
00008E 216A       1485          BOC   NALCO,CHKIBG            MIGHT NOT BE TRUE TM,GO CHK AGAIN
00008F 9800       1489          ORM   TRACER,0              GET TRACE REG TO DBUS FOR BRANCHING
000090 35B1       1492          BOC   DREG5,WAITEND         SKIP IF FILE SEARCH IS ON
                  1494 * SET UNIT EXCEPTION
000091 8404       1496          ORI   STATIMG,SETSTATB      TRN ON STAT B FOR ENDUP
000092 60B1       1499          BU    WAITEND                  FLAGS UNIT EXCEPTION TO ALU1
                  1504 ***********************************************************************
                  1505 * WE WILL END UP HERE WHEN AN IBG IS DETECTED, IN TWO INSTANCES.       *
                  1506 * THE FIRST IS WHILE WE ARE WAITING FOR IBG TO FALL AFTER WE START     *
                  1507 *ITAPE MOVING. IN THIS CASE WE WILL GO RIGHT BACK TO THE MAIN LOOP.    *
                  1508 *'THE SECOND IS ON A SPACE OP WHEN THE ENDING IBG IS DETECTED.         *
                  1509 ***********************************************************************
000093 9800       1511 IBGYES1  ORM   TRACER,0              GET TRACE REG TO DBUS FOR TESTING
000094 3197       1514          BOC   BORMARK,IBGYES2       BR IF BOR TRACE IS ON
000095 3397       1517          BOC   IBGMARK,IBGYES2       BR IF IBG TRACE IS ON
000096 606C       1520          BU    CLOKWAIT              GO BACK TO START LOOP
000097 37B1       1523 IBGYES2  BOC   SPACEOP,WAITEND       BR IF SPACE OP IS ON
000098 C8AF       1526          AND   TRACER,ONES-BORMARK-IBGMARK  RESET TRACERS
000099 6063       1529          BU    SETUXCNT              GO BACK TO START LOOP + RESET UEX CT


                  1533 ***********************************************************************
                  1534 * TO GET HERE WE MUST BE DOING A READ OP AND HAVE SEEN DATA READY.     *
                  1535 * THE MAIN JOB NOE  IS TO ASSURE END DATA IS FLAGGED NEXT. IBG OR      *
                  1536 * DRIVE INTERRUPT SIGNAL AN ERROR CONDITION                            *
                  1537 ***********************************************************************
00009A 289E       1539 PREAMBOK BOC   ENDATA,READEND        BR IF END DATA COMES ON
00009B 2FAE       1542          BOC   IBG,SETPARTL          BO IF IBG COMES ON
00009C 3FB3       1545          BOC   DEVATTN,SETNOISE      BR IF TU INTERRUPT COMES ON
00009D 609A       1548          BU    PREAMBOK              HANG TILL RECORD ENDS
                  1552 ***********************************************************************
                  1553 * NORMAL READ END- WE HAVE NOW SEEN END DATA. NOW WE MUST COUNT        *
                  1554 * THE POSTAMBLE DATA READYS TO ASSSURF NO MORE THAN 42. AN EXCESS WILL*
                  1555 * FORCE END DATA CHK.                      AND EXCESSIVE POSTAMBLE..   *
                  1556 * A COUNT OF 50 IS USED TO ALLOW FOR WORST CASE AMP SENSOR DROP OUT   *
                  1557 * TIME.  A SECOND CHECK IS MADE TO ASSURE AT LEAST SIX CELLS OF BURST *
                  1558 * OCCUR AFTER ENDDATA. IF NOT,END DATA CHK IS SET ALONE.              *
                  1559 ***********************************************************************
```

```
00009E 09CD   READEND   STO    FRU,ONES-50           LOAD THE COMP OF DEC 50
00009F 2DA9   RDYWAIT1  BOC    DATARDY,CNTRDY1       BR TO CT ONE DATA RDY
0000A0 2FA6             BOC    IBG,CHKPOST           BR TO EXIT
0000A1 609F             BU     RDYWAIT1              WAIT FOR DATA RDY TO RISE
0000A2 2FA6   IBGLOOK1  BOC    IBG,CHKPOST           NORMAL EXIT
0000A3 3FB3             BOC    DEVATTN,SETNOISE      ABEND ON TU DEV END
0000A4 2DA2             BOC    DATARDY,IBGLOOK1      HANG IN LOOP TILL DATA RDY FALLS
0000A5 609F             BU     RDYWAIT1              NOW GO WAIT FOR NEXT DATA RDY

0000A6 B929   CHKPOST   ADDM   FRU,41                ASSURE AT LEAST
0000A7 21AC             BOC    NALCO,SETENDCK          6 BIT CELLS OCCUR
0000A8 60B6             BU     STOPREAD                  AFTER ENDING ONES

0000A9 A901   CNTRDY1   ADD    FRU,1                 ADD ONE TO CNT
0000AA 21A2             BOC    NALCO,IBGLOOK1        ABORT IF 43 ZEROS DETECTED

              *                ***** SET EXCESSIVE POSTAMBLE *****

0000AB BA02             ORI    DTACHK2,EXCPOST         EXCESSIVE POST AMBLE
              *                ***** SET END DATA CHECK *****

0000AC 1810   SETENDCK  STO    MPGMERR,ENDATAER      SET END DATA CHK
0000AD 60B1             BU     WAITEND               RETURN TO WAIT SOME MORE

              *                ***** SET PARTIAL RECORD *****

0000AE 8A04   SETPARTL  ORI    DTACHK2,PARTREC         SET PARTIAL RECORD
0000AF 60AC             BU     SETENDCK

              *                ***** SET START READ CHECK *****

0000B0 8A08   SETRDCHK  ORI    DTACHK2,STREADCK      SET START READ CHECK
0000B1 2FB6   WAITEND   BOC    IBG,STOPREAD          BR IF IBG IS ON
0000B2 60B1             BU     WAITEND               WAIT FOR IBG

              *                ***** SET NOISE ERROR *****

0000B3 1880   SETNOISE  STO    MPGMERR,NOISE         SET NOISE ERROR
0000B4 8402   ABORTRD   ORI    STATIMG,SETSTATC      FLAG UNIT CHECK
0000B5 0100             STO    WORK2,0               CLEAR NOISE BIT

0000B6        STOPREAD  EQU    *
000CB6 3ABF             BOC    STATC,DIAGHOOK        TOUCHE
0000B7 D801             ANDM   TRACER,SPACEOP        IS THIS A RECORD SPACE OP
0000B8 37D9             BOC    SPACEOP,CRESENS       BR IF SO
0000B9 CDD7   READSTOP  AND    XOUTAIM,ONES-FORCE-NOLOSS
0000BA 4D42             XFR    XOUTAIM,XOUTA         DEACTIVATE FORCE AND NOT ALLOW
0000BB 00CD             STO    WORK1,ONES-50         SET 20 MICRO SEC. DELAY
0000BC A001   DELAY     ADD    WORK1,ONE             DO THE DELAY
0000BD 21BC             BOC    NALCO,DELAY            FOR SERVICE TO STOP
0000BE 61C1   TOENDUP   BU     ENDUP
0000BF 6513   DIAGHOOK  BU     MEASIBG               GO MEASURE IBG
              ********************************* FETCH STATUS SUBROUTINE ***************
              * THIS SUBROUTINE IS USED BY ANY ROUTINE REQUIRING SENSE DATA FROM       *
              * THE DEVICE. TWO BYTES OF SENSE DATA WILL BE RETURNED AND CONTROL       *
              * RELINQUISHED TO THE CALLING ROUTINE VIA LINK REG 1.                    *
              *                                                                        *
              **************************************************************************


0000C0 0000   FCHSTS    STO    WORK1,0                CLEAR THE TU
0000C1 4060             XFR    WORK1,TUBO               BUS OUT
0000C2 0008             STO    WORK1,DEVSEL          SET SELECT & RESET ALL OTHER TAGS
0000C3 4024             XFR    WORK1,TUTAG            IF THEY ARE ON
0000C4 0001             STO    WORK1,1               SET FOR SENSE BYTE ZERO *****
0000C5 4060   FCHSNS    XFR    WORK1,TUBO            XFER TO THE TAPE UNIT BUS OUT REG
0000C6 06FD             STO    SENSE1,ONES-2         LOAD WAIT COUNT
0000C7 A601   HUP1      ADD    SENSE1,1                AND
0000C8 21C7             BOC    NALCO,HUP1                WAIT
0000C9 4681             XFR    SENSE1,TUBI           FETCH 1ST SENSE BYTE
0000CA 5681             XFRH   SENSE1,TUBI            AND PUT IT IN HIGH REG ALSO
0000CB 4021   FCHLAST   XFR    WORK1,AR              SHIFT BIT LEFT IF
0000CC A000             ADD    WORK1,ZERO             NOT
0000CD 4060   FCHNEXT   XFR    WORK1,TUBO            MOVE TO TAPE BUS OUT
0000CE 07FE             STO    SENSE2,ONES-1         LOAD WAIT COUNT
0000CF A701   HUP2      ADD SENSE2,1                   AND
0000D0 21CF             BOC    NALCO,HUP2                WAIT
0000D1 4781             XFR    SENSE2,TUBI           FETCH 2ND SENSE BYTE
0000D2 4021             XFR    WORK1,AR               SET UP FOR
0000D3 A000             ADD    WORK1,0                 SENSE OP
0000D4 5C22             XFR    LINK1,IC              RETURN TO CALLLER
              *********************** STATUS FETCH BRANCH TABLE ***********************
0000D5 6107   SRETURN1  BU     STATUS1               INIT STATUS RETURN                 *
0000D6 61C6   SRETURN2  BU     SNSRTN                ENDVP RETURN                       *
0000D7 6364   SRETURN3  BU     POLL6                 DEV END RETURN
0000D8 63F6   SRETURN4  BU     SNSLINK               RETURN TO SENSE ROUTINE
              * SRETURN7 IS IN FRONT OF PAGE 0 AT BRANCH TABLE
              *************************************************************************
              *************************************************************************
              * NORMAL ENDING OF ANY SPACE OP IS THROUGH THIS ROUTINE.  AFTER MOVE     *
              * IS DROPPED WE WILL MONITOR THE READ BUS UNTIL THE TACH PULSE SPREAD    *
              * SHOWS THE DRIVE TO BE STOPPED.      IF ANY READ DATA IS DETECTED,      *
              * DURING THIS TIME, MOVE IS RAISED UNTIL IBG IS AGAIN DETECTED.          *
              *************************************************************************
```

```
0000D9 C4BF     CRESENS  AND    STATIMG,ONES-PERMRDWT     RESET
0000DA 4428              XFR    STATIMG,STAT               READ CONDITION
0000DB 8880              ORI    TRACER,CREASER            SET FLAG FOR TAK RTN
0000DC 0008              STO    WORK1,DEVSEL              DROP MOVE
0000DD 4024              XFR    WORK1,TUTAG                TAG
0000DE 0040              STO    WORK1,DVESNS6             SET SENSE BIT ON
0000DF 1C4D              STO    LINK1,CRETEST             SET RETURN ADDRESS
0000E0 60CD              BU     FCHNEXT                   GO SET SENSE BIT TO DRIVE.

                *  SENSE BYTES 0 AND 1

0000E1 0281     EXECSNS  STO    WORK3,X'81'               PATTERN FOR MASK
0000E2 5821              XFR    MPGMERR,AR                MASK AGAINST NOT CAP + NOISE
0000E3 C200              AND    WORK3,ZERO                SET IN REG IF ON
0000E4 0100              STO    WORK2,0                   CLEAR REG FOR LATER
0000E5 9600     SNS0     ORM    SENSE1,ZERO               IS A DRIVE PRESENT
0000E6 20F9              BOC    DBUS,SNS1                 BR IF NOT
0000E7 35FB              BOC    START,SNS2                BR IF START IS ON
0000E8 8220              ORI    WORK3,TUSTB               SET TU STATUS B IF NOT
0000E9 8140     SNS1     ORI    WORK2,INTREQ              SET INTERVENTION REQUIRED
0000EA 638A              BU     SNS3                      GO DO NEXT TEST

0000EB 8240     SNS2     ORI    WORK3,TUSTA               SET TU STATUS A ON
0000EC 638A              BU     SNS3                      GO FINISH SENSE OP

                ******************************************************************
                *                                                                *
                *                  INITIAL SELECTION OF TAPE UNIT                *
                *                                                                *
                ******************************************************************
                ******************************************************************
                * THIS ROUTINE WILL GET THE TAPE UNIT ADDRESS FROM THE EXTERNAL  *
                * ADDRESS REGISTER IN THE PROPER BIT POSITION AND PUT IT IN THE  *
                * PROPER REGISTER.                                               *
                *                                                                *
                *          TUADDR LSR LAYOUT (LOW)    TUADDR LSR LAYOUT (HIGH)   *
                *          0 SELECT TU7               0 SELECT TU15              *
                *           1 SELECT TU6               1 SELECT TU14             *
                *            2 SELECT TU5               2 SELECT TU13            *
                *             3 SELECT TU4               3 SELECT TU12           *
                *              4 SELECT TU3               4 SELECT TU11          *
                *               5 SELECT TU2               5 SELECT TU10         *
                *                6 SELECT TU1               6 SELECT TU9         *
                *                 7 SELECT TU0               7 SELECT TU8        *
                *                                                                *
                ******************************************************************
                * THERE ARE TWO TUADDR LSRS,ONE HIGH & THE OTHER LOW.WHICH ONE IS USED*
                * DEPENDS ON THE ADDRESS PASSED BY AL1. THIS ALLOWS THE MPGM WITH *
                * THE MEANS TO KNOW WHICH DEVICE HE IS WORKING.                  *

0000ED 4B84     EXECSTS  XFR    TUADDR,XADDR              SET DEVICE ADDR
0000EE 5B84              XFRH   TUADDR,XADDR               IN BOTH REGS
0000EF 4190              XFR    WORK2,XINA                GET TU ADDR FROM ALU1
0000F0 34F5              BOC    SELHIGH,CLEARLO           BR IF OPERATING HI DRIVES
0000F1 1B00              STOH   TUADDR,0                  CLEAR HIGH ADDR REG
0000F2 0408              STO    STATIMG,SETSTATA          SET STAT A TO
0000F3 4428              XFR    STATIMG,STAT                DENOTE LOW ORDER
0000F4 6100              BU     ADDREXIT                  GO DO INITIAL SELECTION
0000F5 0B00     CLEARLO  STO    TUADDR,0                  CLEAR LOW ADDR REG
0000F6 6100              BU     ADDREXIT                  GO FINISH INITIAL SELECTION
                         ORG    BEGIN+X'100'
                ********************** INITIAL STATUS ROUTINE ********************
                * THIS ROUTINE,UPON REQUEST BY ALU1,GETS TWO SENSE BYTES FROM THE *
                * SELECTED DRIVE AND PASSES THEM TO ALU1. A CHECK IS MADE TO SEE IF *
                * THE DRIVE IS AVAILABLE AND NOT BUSY. STATS ARE USED TO COMMUNICATE *
                * FINDINGS TO ALU1. VARIOUS REGISTERS ARE SET TO RESET STATUS.   *
                *                                                                *
                * CLEAN STATUS    STATD ALONE                                    *
                * BUSY STATUS     STATB AND STATD  -DRIVE IS REWINDING,SWITCHED OR DSE *
                * UNIT CHECK STATUS  STATC AND STATD-DRIVE IS NOT THERE OR NOT READY *
                * DEVICE END PENDING STATB AND STATC                             *
                * UNIT CHK AND DEV END PENDING -STAT C                           *
                * IF DEVICE IS FOUND BUSY,A DEVICE END WILL BE PRIMED.           *
                ******************************************************************
000100          ADDREXIT EQU    *                         ENTRY FROM ADDR ROUTINE
000100 3E05     CHKSWTCH BOC    BSYTACH,GOPRIME           BR IF SWITCHED
000101 1CD5     EXECSTSZ STO    LINK1,SRETURN1            SET UP RETURN
000102 60C0              BU     FCHSTS                    RETURN TO STATUS1
000103          ISBUSY1  EQU    *
000103 0000     PRIMESET STO    WORK1,ZERO                CLEAR DEVICE SEL IF ON
000104 4024              XFR    WORK1,TUTAG               TO ASSURE NOT LEFT OUTSTANDING
000105 3A36     GOPRIME  BOC    STATC,TOSETD              BR TO GET OUT
000106 61EA              BU     SETPRIME                  GO PRIME DEVICE END

                ******************************************************************
                * RETURN FROM FETCH STATUS ROUTINE  -  INTERROGATE SENSE DATA    *
                ******************************************************************

000107 4641     STATUS1  XFR    SENSE1,XOUTB              SEND TU SNS
000108 3E03              BOC    BSYTACH,ISBUSY1           BR IF BUSY(REW,RUN OR DSE)

                ******************************************************************
                *  INITIALIZE XOUTA IMAGE REG
                ******************************************************************
```

```
000109 0D47   STATUSOK STO    XOUTAIM,X'47'        SET UP TO LOAD MODEL NO.
00010A 4721            XFR    SENSE2,AR            GET MOD NO TO A REG
00010B CD40            AND    XOUTAIM,X'40'         AND PUT IT IN XOUTA

              *****************************************************************
              * LOOK FOR DEVICE END PRIME ROUTINE.                            *
              *****************************************************************

00010C 2A0E   HAVPRIME BOC    STATA,LOWYES         STAT A ON SAYS LOW ADDR
00010D 5006   MUSTBEHI XFRH   LSR                  SET HIGH                      16
00010E 4F21   LOWYES   XFR    LODEPB,AR            MOVE PRIME LSR TO AREG,(INTRF B)
00010F 2B12            BOC    STATB,SOCKEM         TEST FOR INTERFACE B
000110 9000            NOP1                        CLEAR A REG IF NOT
000111 4E21            XFR    LODEPA,AR            MOVE PRIME LSR TO AREG,(INTF A)
000112 DB00   SOCKEM   ANDM   TUADDR,0             LOOK FOR PRIME
000113 2017            BOC    DBUS,NOPRIME         BR IF NOT
```

(Omitted Nonpertinent Coding)

```
              ********************** GENERAL AND SELECTIVE RESETS *******************
              *                                                                     *
              * DEPENDING ON ENTRY POINT, A SELECTIVE OR GENERAL RESET WILL BE      *
              * PERFORMED.  SELECTIVE BYPASSES RESET OF DEVICE END PRIMES AND       *
              * COMMITTED LATCH. OTHERWISE THE TWO RESETS ARE THE SAME.
              ***********************************************************************

000193 2B97   EXECGRST BOC    STATB,RESTDEB        BRANCH IF RESET IS FOR INTERFACEB *M
000194 0E00            STO    LODEPA,0             CLEAR DE PRIME REGISTER A
000195 1E00            STOH   LODEPA,0             CLEAR DE PRIME REGISTER A HIGH   *16
000196 6199            BU     EXECSRST
000197 0F00   RESTDEB  STO    LODEPB,0             CLEAR DE PRIME REGISTER B     *MIS**
000198 1F00            STOH   LODEPB,0             CLEAR DE PRIME REGISTER B HIGH   *16

000199 1C0F   EXECSRST STO    LINK1,SRETURN7-BEGIN  SET UP FOR RETURN
00019A 60C0            BU     FC4STS                 AND GO SELECT DEVICE
00019B 100A   CAPIM    STOH   WORK1,DEVSEL+COMMAND S UP COMMAND FOR RESETG
00019C 1102            STOH   WORK2,RESET          GET DRIVE RESET READY
00019D 5024            XFRH   WORK1,TUTAG          RAISE COMMAND TAG TO DRIVE
00019E 1008            STOH   WORK1,DEVSEL         CLEAR OUT COMMAND TAG
00019F 5160            XFRH   WORK2,TUBO           AND RESET IT
0001A0 3BA2            BOC    STATD,CLEEREM        DON'T CHECK STAT C
0001A1 3AB2            BOC    STATC,RESET1         BR IF THIS IS AN ALU ERR RESET
0001A2 0C00   CLEEREM  STO    DTACHK1,0             CLEAR
0001A3 0A00            STO    DTACHK2,0            ERROR
0001A4 1D00            STO    EQUIPCK,0             REGS
0001A5 1800            STO    MPGMERR,0
0001A6 0900            STO    FRU,0
0001A7 0800            STO    TRACER,0             CLEAR TRACE REGISTER
0001A8 3BBD            BOC    STATD,CLEARCMD       BR IF THIS IS A SENSE RESET
0001A9 0500            STO    FLAGS,0              CLEAR FLAGS REG
0001AA F109            XOM    WORK2,NDXSRST-BEGIN    IS THIS A SELECTIVE RESET
0001AB 20B2            BOC    DBUS,RESET1          BR IF SO

              **************** DESELECT TAPE UNIT ***********************************
              * THIS ROUTINE IS USED AFTER EACH OPERATION TO ASSURE DE-SELECT OF THE*
              * TAPE UNIT. THE COMMITTED LATCH WILL ALSO BE RESET.                  *
              ***********************************************************************
0001AC 0000   EXECDES  STO    WORK1,ZERO           CLEAR TAGS
0001AD 4024            XFR    WORK1,TUTAG           TO THE DRIVE
0001AE A024   DESWAIT  ADD    WORK1,36             ALLOW X POINTS
0001AF 21AE            BOC    NALCO,DESWAIT          TO SETTLE 3.2 USEC DELAY
0001B0 4050            XFR    COMITD               RESET THE DEVICE COMMITTED LATCH
0001B1 6011            BU     SETDLONE             GO SET STAT D AND TERMINATE

              * CHECK FOR DEV END PRIME. IF ONE IS FOUND BYPASS RESET TO COMMITTED.

0001B2 4E21   RESET1   XFR    LODEPA,AR            SET DEV END PRIMES TO TEST A
0001B3 4F21   RESET2   XFR    LODEPB,AR            SET DEV END PRIMES TO TEST B
0001B4 DB00   RESET3   ANDM   TUADDR,ZERO          DO ADDR AND DEV PRIME COMPARE
0001B5 20B7            BOC    DBUS,CHKHI           BR IF NOT
0001B6 61BC            BU     EXECABRT                                         *16
0001B7 5006   CHKHI    XFRH   LSR                  SET HI                      *16
0001B8 4E21            XFR    LODEPA,AR             LOOK FOR                   *16
0001B9 4F21            XFR    LODEPB,AR               HIGH PRIMES              *16
0001BA DB00            ANDM   TUADDR,0             BR OUT                      *16
0001BB 20AC            BOC    DBUS,EXECDES           IF NONE                   *16
              ************************** ABORT ROUTINE ******************************
              *                                                                     *
              *  USED BY ALU1 TO INSURE TAPE MOTION IS STOPPED.                     *
              *                                                                     *
              *  THIS ROUTINE MUST FOLLOW RESETS ROUTINE                            *
              ***********************************************************************

0001BC 1000   EXECABRT STOH   WORK1,ZERO           CLEAR REG

0001BD 5024   CLEARCMD XFRH   WORK1,TUTAG           DROP ALL DRIVE TAGS
0001BE 6011            BU     SETDLONE             ALL DONE
              *               ***** SET CONTROL STATUS REJECT *****
```

```
0001BF 1D20     2677 CTRLREJ  STO   EQUIPCK,REJCTRL      SET CONTROL STATUS REJECT
0001C0 0100     2680 CLRXOUTA STO   WORK2,0              ASSURE NOISE BIT OFF - READ OP -
                2684 ************************** ENDUP ROUTINE ******************************
                2685 *                                                                      *
                2686 * THE ENDUP ROUTINE IS ENTERED BY ALL CMD ROUTINES.                    *
                2687 *         ENDUP SETS THE STATUS INTO THE STAT REG AND SETS STAT D TO   *
                2688 * INDICATE TO ALU1, ALU2 IS FINISHED. ALU2 WILL BE TRAPPED TO ADDRESS  *
                2689 * ZERO WHEN STAT D IS SET AND WILL REMAIN DORMANT UNTIL CALLED BY      *
                2690 * ALU1 AGAIN,(VIA ALU1 XOUTB)                                          *
                2691 *    THE DEVICE STATUS IS ALWYS RETRIEVED AND CHECKED FOR UNIT CHECK   *
                2692 * AND UNIT EXCEPTION CONDITIONS(EOT ON WRITE). THE MPGM ERROR REG IS   *
                2693 * CHECKED AND IF ANY BITS ARE ON, THE UNIT CHECK STAT IS SET.          *
                2694 *                                                                      *
                2695 ************************************************************************


0001C1 C43F     2699 ENDUP    AND   STATIMG,ONES-TAPEOP-PERMRDWT   OP
0001C2 1CD6     2702          STO   LINK1,SRETURN2       LOAD SENSE RETURN  (SNSRTN)
0001C3 4428     2705          XFR   STATIMG,STAT         RESET TAPE IP AND CONTROLS
0001C4 4142     2708          XFR   WORK2,XOUTA          SET BYTE FOR ALU1-READ NOISE
0001C5 60C0     2711          BU    FCHSTS               GO FETCH DEVICE SENSE DATA
0001C6 2ADB     2714 SNSRTN   BOC   STATA,BUSYYET        BR IF A REW,RUN,ORDSE
0001C7 9600     2717          ORM   SENSE1,0              GET SENSE BYTE FIR TEST
0001C8 34CA     2720          BOC   WRTSTAT,CHKEOT        BR IF EOT IS ON
0001C9 61CD     2723          BU    ENDCHK
0001CA 32CC     2726 CHKEOT   BOC   EOT,SETUX            IS END OF TAPE BIT ON
0001CB 61CD     2729          BU    ENDCHK   HK           OR IF NOT
0001CC 8404     2732 SETUX    ORI   STATIMG,SETSTATB     SET UNIT EXCEPTION IF SO
0001CD          2734 ENDCHK   EQU   *
0001CD          2735 CKSTART  EQU   *
0001CD 9600     2737          ORM   SENSE1,0             IS DRIVE READY
0001CE 35D0     2740          BOC   START,TSTFOERR       BR IF START IS ON
0001CF 1D40     2743          STO   EQUIPCK,REJTU        OTHERWISE SET ERROR ON
0001D0 DCFE     2746 TSTFOERR ANDM  DTACHK1,ONES-VELTRY  BR IF NO ERRORS IN THESE
0001D1 20D3     2749          BOC   DBUS,TSTFOMOR         REGS
0001D2 61D7     2752          BU    SETUCK               OTHERWISE GO SET UNIT CHECK
0001D3 5821     2755 TSTFOMOR XFR   MPGMERR,AR           SET UP ERRORS
0001D4 5D21     2758          XFR   EQUIPCK,AR            FOR TEST
0001D5 9A00     2761          ORM   DTACHK2,0             ANY M-PGM ERRORS
0001D6 20D9     2764          BOC   DBUS,DUNAGN           BR IF NOT
0001D7 8402     2767 SETUCK   ORI   STATIMG,SETSTATC     SET UNIT CHECK STAT ON

0001D8 4014     2771          XFR   REDLIGHT FLAG ALU DETECTED DATA ERROR
0001D9          2773 DUNAGN   EQU   *
0001D9 8401     2775 SETD     ORI   STATIMG,SETSTATD     TURN ON STATD
0001DA 4428     2778          XFR   STATIMG,STAT         XFER STAT IMAGE TO STAT REG
                2780 *************** ALU2 IS NOW TRAPPED UNTIL CALLED BY ALU1
                2783 ************************************************************************
                2784 * REWIND,REWIND UNLOAD AND DATA SECURITY ERASE USE THIS ROUTINE        *
                2785 * TO ASSURE THE DEVICE WENT BUSY. IF IT DIDNT, A CHECK IS MADE         *
                2786 * TO SEE IF THE OPERATION HAS BEEN COMPLETED.   CHAINING OF THESE     *
                2787 * COMMANDS IS SIGNALED BY ALU1 STATD BEING ON, AND ALU2 WILL          *
                2788 * REMAIN HERE IN ENDUP UNTIL THE TAPE UNIT IS FINISHED.               *
                2789 ************************************************************************
0001DB          2790 BUSYYET  EQU   *
0001DB 4088     2792          XFR   WORK1,XINB           GET THE CURRENT CMD INDEX
0001DC F029     2795          XOM   WORK1,EXECRWU        IS IT A REWIND UNLOAD
0001DD 2020     2798          BOC   DBUS,SETPULSE        BR IF SO
0001DE D6FF     2801          ANDM  SENSE1,ONES          GET SENSE BYTE FOR TEST
0001DF 37E2     2804          BOC   NOTBUSY,LPLOOK       BR IF NOT BUSY
0001E0 3BC1     2807          BOC   STATD,ENDUP          IF CHAINED-STATD WILL BE ON-
0001E1 61CD     2810          BU    CKSTART              IF NOT CHAINED-TAKE NORMAL EXIT
0001E2 33E6     2813 LPLOOK   BOC   BOT,ISITREW          BR IF BOT IS ON
0001E3 32E8     2816          BOC   EOT,ISITDSE          BR IF EOT IS ON
0001E4 8402     2819          ORI   STATIMG,SETSTATC     SET UNIT CHECK ON
0001E5 61CD     2822          BU    CKSTART              NOT BUSY AND NOT AT LP OR TI
0001E6 34D7     2825 ISITREW  BOC   WRTSTAT,SETUCK       BR IF NOT-MUST BE REW/RUN
0001E7 61CD     2828          BU    CKSTART              SET U.C.-WE HIT LP ON A DSE
0001E8 34CD     2831 ISITDSE  BOC   WRTSTAT,ENDCHK       SET U.C. IF NOT-WE HIT T1 ON A REW
0001E9 61CD     2834          BU    CKSTART              DSE COMPLETE-GO FINISH UP
                2838 ***************SET DEVICE END PRIME ROUTINE****************************
                2839 * THIS ROUTINE IS USED BY ALU1 TO PRIME THE DEVICE END STILL HELD      *
                2840 * BY ALU2 IN TUADDR LES. UPON PRIMING, A BRANCH WILL BE TAKEN TO      *
                2841 * POLLMTI WHERE A WAIT WILL BE INITIATED IN CASE ALU1 WANTS IT TURNED *
                2842 * OFF AGAIN.                                                           *
                2843 * NOTE  INITIAL STATUS DOES NOT TAKE THIS BRANCH.                      *
                2844 ************************************************************************

0001EA 0405     2847 SETPRIME STO   STATIMG,SETSTATB+SETSTATD  SET FOR USE LATER
0001EB 1405     2850          STOH  STATIMG,SETSTATB+SETSTATD  SET FOR USE LATER IF HI
0001EC 9B00     2853 EXECSDE  ORM   TUADDR,0             SEE IF LOW LSR HOLDS ADDRESS      16
0001ED 20EF     2856          BOC   DBUS,ISHIGH          BR IF NOT TO SET HI               16
0001EE 61F0     2859          BU    ISLOW                SKIP SET HIGH                     16
0001EF 5006     2862 ISHIGH   XFRH  LSR                  SET HIGH                          16
0001F0 4B21     2865 ISLOW    XFR   TUADDR,AR            GET PRIME BIT TO A BUS
0001F1 2BF3     2868          BOC   STATB,DOIT           BR IF INTERFACE B
0001F2 8E00     2871          ORI   LODEPA,0             PRIME PROPER
0001F3 8F00     2874 DOIT     ORI   LODEPB,0               DEVICE END
0001F4 4428     2877          XFR   STATIMG,STAT         SET STAT D IF NECESSARY
0001F5 8402     2880          ORI   STATIMG,SETSTATC     SET STAT C FOR
0001F6 4428     2883          XFR   STATIMG,STAT           ALU14
0001F7 636A     2886          BU    POLLMTIX             GO WAIT TO RESET THE DEVICE END
                2888 *                                   IF STAT D DIDN'T COME ON IN THE
                2889 *                                   PREVIOUS INSTRUCTION
```

```
0001F8 0403    GOPRIME2 STO    STATIMG,SETSTATD+SETSTATC  SET UP FOR LATER
0001F9 1403             STOH   STATIMG,SETSTATD+SETSTATC  SET UP FOR LATER
0001FA 61EC             BU     EXECSDE                 GO SET A PRIME ON
000200                  ORG    BEGIN+X'200'
               *************************** WRITE ROUTINE ********************************
               *        PARTS OF THE FOLLOWING RTN ARE SHARED BY WRITE,WTM AND ERG.    *
               *  THESE COMMENTS ARE ARRANGED IN THE FOLLOWING SEQUENCE.               *
               *      A.  PE WRITE                                                     *
               *      B.  DIAGNOSTICS- 1. LWR                                          *
               *                       2. LWTM                                         *
               *                       3. INHIBIT PREAMBLE                             *
               *                       4. IMHIBIT POSTAMBLE                            *
               *                       5. DIAGNOSTIC WRITE (DEAD TRACK)                *
               *                                                                       *
               *  NOTE:
               *  ANY OR ALL OF THE DIAGNOSTIC CONTROLS MAY BE USED EITHER             *
               *  SINGLY OR IN ANY COMBINATION EITHER NORMAL WRITE OR LWR.             *
               *************************************************************************

               *  ENTRY TO THIS ROUTINE IS 'WRTSTR' AFTER GAP CONTROL RESPONSE         *
               *  FROM THE DRIVE.                                                      *
               *  AN EXIT IS TAKEN TO CHECK THE DRIVE VELOCITY AND COUNT               *
               *  8 TACH PULSES TO INSURE FORWARD CREEP.  RETURN IS TO                 *
               *  'WRTST'.  WHERE A BRANCH WILL BE TAKEN IF FEATURE IS                 *
               *  PRESENT TO 'WRTSINR2' WHERE A CHECK IS MADE TO DETERMINE MODE FOR    *
               *  THIS OPERATION AND RETURN TO 'WRTST1' IF PE.                         *
               *                                                                       *
               *  IF BOT IS ON IN THE DEVICE SENSE BYTE 0 THEN A P BURST               *
               *  WILL BE WRITTEN.  RETURN ADDRESS IS 'RETURN' WHERE AN EXIT           *
               *  MAY BE TAKEN IF NECESSARY FOR OTHER THAN A WRITE OP.                 *
               *  THEN 39 ZEROS ARE WRITTEN AND AT THE FALL OF WRITE TIME THE          *
               *  FORMAT COUNTER IS STEPPED TO 2 AND DATA FLOW WILL STEP ON TO FC-3    *
               *  AND ALSO TO FC-4.                                                    *
               *                                                                       *
               *  A COUNTER IS MAINTAINED LOOKING FOR EITHER 'BLOCK' TO RISE OR        *
               *  IBG TO FALL AT WHICH TIME THE COUNTER WILL BE STOPPED                *
               *  IF THE COUNT IS EXHAUSTED THEN 'SLOWBEGN' ERROR WILL BE SET          *
               *  WHILE A TEST IS MADE FOR THE BLOCK TO BE PRESENT AND IF SO THEN SET*
               *  'BORFLAG' A COUNT IS MADE UNTIL 16 BIT CELLS HAVE BEEN COUNTEDTHEN *
               *  FORCE AND NO LOSS WILL BE SET IN XOUTA REGISTER                      *
               *                                                                       *
               *  AT THIS POINT STOP IS CHECKED AND IF NOT ON THEN AN EXIT             *
               *  IS TAKEN TO CHECK VELOCITY VIA THE TACH VELOCITY ROUTINE UNTIL       *
               *  'STOP' COMES ON AT WHICH TIME RETURN IS MADE TO 'WRTCK10'            *
               *  IF STOP IS ON THEN THE ENDING FORMAT WILL BE WRITTEN AT THIS         *
               *  TIME. INSTEAD OF EXIT  TO CHECK VELOCITY                             *
               *                                                                       *
               *  THE WRITING OF THE ENDING 1'S MARKER AND 40 ZEROS WILL BEGIN WHEN    *
               *  THE FORMAT COUNTER STEPS OUT OF FC-3. A COUNT WILL BE MAINTAINED     *
               *  OF THE ENDING 40 BURST. 'PERMRDWT' WILL BE RESET IN THE STAT         *
               *  REGISTER WHEN THE FORMAT IS COMPLETED                                *
               *  WHILE STILL WRITING DATA (IN FC-3) IF IBG COMES UP THEN MOVE         *
               *  TAG WILL BE DROPPED TO THE DRIVE-SIGNALS A CREASE-IBG DROP ERROR     *
               *  WILL BE SET.                                                         *
               *                                                                       *
               *  NOTE - MOVE WILL NOT DROP IF IN DIAGNOSTIC WRITE (DEAD TRK MODE)     *
               *                                                                       *
               *  A COUNTER IS MAINTAINED WHILE WAITING FOR 'IBG' OR 'ENDATA'          *
               *  WITH THE NORMAL EXIT BEING ENDATA - HOWEVER IF THE COUNT             *
               *  IS EXHAUSTED THEN 'END DATA CK' WILL BE SET.                         *
               *                                                                       *
               *  A COUNTER IS USED TO MEASURE THE LENGTH OF THE ENDING                *
               *  40 ZEROS AND WHEN THE COUNT EXPIRES THEN 'FORCE AND NO LOSS'         *
               *  WILL BE RESET                                                        *
               *                                                                       *
               *  WHEN IBG COMES UP THEN COUNTS WILL BE CHECKED FOR                    *
               *  EARLY BEGIN READ BACK CHECK AND EARLY ENDING READ BACK               *
               *  CHECK. THE 'BORFLAG' WILL BE CHECKED AND IF OFF THEN                 *
               *  EQUIP CK - 'NO BLOCK ON RECORD READ BACK CHECK' WILL BE SET.         *
               *  THEN EXIT TO 'READSTOP' WHICH GOES TO ENDUP                          *
               *************************************************************************
               *************************************************************************
               *                                                                       *
               *  PE LOOP WRITE TO READ.                                               *
               *                                                                       *
               *  THE COMMAND WAS SET UP ON INITIAL ENTRY AT 'EXECWRT'                 *
               *  AND ISSUED TO THE TAPE UNIT IN 'TURN - AROUND' THE                   *
               *  EXIT FROM TURN-AROUND DROPPED THE COMMAND TAG AND DID                *
               *  NOT GO TO TACH COUNTER. THE MOVE TAG IS STILL ACTIVE TO              *
               *  THE DRIVE BUT WILL BE DEGATED IN THE DRIVE TO INHIBIT MOVING TAPE    *
               *  THE FORMAT WILL BE WRITTEN AND ALL CONTROL LINES WILL                *
               *  BE EFFECTIVE AT THE SAME POINTS IN THE RECORD IE: PERMRDWT,          *
               *  FORCE, NOLOSS, AND SFC.                                              *
               *                                                                       *
               *  ALU1 STATC AND BIT 5 (LWROP) IN THE FLAGS REGISTER ARE CONTROL       *
               *  FOR LWR.                                                             *
               *                                                                       *
               *  WHEN THE OPERATION IS COMPLETE EXCESS POSTAMBLE AND E, AND           *
               *  SLOW BEGIN AND END CHECKS ARE MADE ALSO ANY EQUIP CHKS ARE RESET     *
               *  IF ON. ANY OTHER ERRORS IF SET ARE VALID.                            *
               *************************************************************************
               *************************************************************************
               *                                                                       *
               *  PE INHIBIT PREAMBLE AND POSTAMBLE                                    *
               *
```

```
                *  THE FLAGS REGISTER MAY OR MAY NOT CONTAIN THE 'INHPRE' OR           *
                *  'INHPOST' FLAG BITS.  IF ON THE BEGINNING                           *
                *  40 ZEROS WILL NOT BE WRITTEN - UNDER CONTROL OF 'INHPRE' FLAG       *
                *  OR ENDING 40 ZEROS WILL NOT BE WRITTEN UNDER CONTROL OF             *
                *  'INHPOST' FLAG.                                                     *
                *                                                                      *
                *  THE DATA WRITTEN UNDER ABOVE CONDITIONS WILL BE FOR 'INHPRE' A 0'S *
                *  BYTE AND 1'S MARKER THEN THE DATA DURING FC-3 AND THE ENDING 1'S    *
                *  MARKER AND A 0 BYTE.                                                *
                *  ALL ERROR CHECKS ARE MADE AND ERRORS SET WHICH APPLY.               *
                *                                                                      *
                *  DIAGNOSTIC OR INHIBIT WRITE TRIGGERS WILL FUNCTION THE SAME AS A    *
                *  NORMAL WRITE WITH THE EXCEPTION IN PE MODE MOVE WILL NOT BE         *
                *  DROPPED IF AN IBG COMES UP DURING FC-3.                             *
                ************************************************************************
000200 6024     ERETURN1 BU    ERGSTR                RETURN TO ERASE GAP ROUTINE

                ************************************************************************
                *  RETURN HERE AFTER GAP CONTROL IS RECEIVED FROM DRIVE AND EXIT       *
                *  TO ASSURE DRIVE IS AT THE CORRECT VELOCITY-NORMAL RETURN TO 'WRTST'*
                *  IF LIMITS ARE NOT MET THEN EXIT TO ENDUP.                           *
                ************************************************************************

000201 1600     WRTSTR   STOH  SENSE1,0              CLEAR THE REG FOR VELOCITY
000202 13E8     VELSTR   STOH  WORK4,ONES-23         SET MAX CNT TO 24
000203 6300              BU    CHKVEL                GO ASSURE VELOCITY IS CORRECT

000204 D610     WRTST1   ANDM  SENSE1,BOT            ARE WE AT BOT
000205 2007              BOC   DBUS,RETURN            BR IF NOT
000206 65F4              BU    WRTP                  BR TO SET UP FOR P TRACK WRITE
                *                                    RETURN IS TO 'RETURN'

000207 8D28     RETURN   ORI   XOUTAIM,NOLOSS+FORCE  SET NO ENVELOP LOSS AND FORCE
000208 03F9              STO   WORK4,ONES-6          SET TO COMPLE OF 7
000209 9800              ORM   TRACER,ZERO           MASK FOR OP
00020A 3699              BOC   WTMOP WTMSTR           AND RETURN TO THE
00020B 3500              BOC   ERGOP,ERETURN1          PROPER ROUTINE
                ************************************************************************
                *  THIS IS PE WRITE OPERATION NOT AT LOAD POINT.  READY TO START      *
                *  THE FORMATED WRITE.                                                 *
                ************************************************************************


00020C 00D9     WRT40Z   STO   WORK1,ONES-38         GET COUNT TO 39
00020D 1C0F              STO   LINK1,WRT1ST          RETURN TO WRITE 1'S MARKER
00020E 62A7              BU    CNTLSETA              GO SET WR COND & COUNT 39 ZEROS
                *                                    RETURN TO 'WRTST1'

00020F 3811     WRT1ST   BOC   WRTIME,WRT1ST1        BR IF WRITE TIME
000210 620F              BU    WRT1ST                BACK UNTIL GET WRTIME
000211 3811     WRT1ST1  BOC   WRTIME,WRT1ST1        WAIT UNTIL GONE
000212 4012              XFR   SFC                   STEP FORMAT COUNTER TO TWO
000213 0123     WRTDATA  STO   WORK2,ONES-220        SET MAX WAIT COUNT
000214 1C15              STO   LINK1,WRTCK           SET RETURN FROM 'CHECKBOR'

                *  THE FORMAT COUNTER WILL STEP FROM 2 TO 3 (DATA TIME)
                ************************************************************************
                *  THE EXITS FROM 'WRTCK' SUBROUTINE ARE:                              *
                *        1.  NFC3 TO 'WRTEND' WHICH COUNTS THE ENDING 40 ZEROS         *
                *        2.  TO CHECK VELOCITY DURING DATA TIME IN WHICH CASE          *
                *            RETURN ON 'STOP' FOR EXIT VIA 1. ABOVE.                   *
                ************************************************************************

000215 3817     WRTCK    BOC   WRTIME,WRTCK1         BR ON WRITE TIME PULSE
000216 6215              BU    WRTCK                  BACK IF NOT
000217 3817     WRTCK1   BOC   WRTIME,WRTCK1         WAIT FOR WRT TIME TO FALL

                ************************************************************************

                *  NORMAL RETURN FROM VELOCITY CHECK DURING DATA                       *
                ************************************************************************

000218 223B     WRTCK10  BOC   NFC3,WRTEND           BR IF FORMAT COUNT 4 OR
000219 3C28     WRTCK2   BOC   BLOCK,CHECKBOR        BR IF STARTING RECORD.
00021A 2F1C              BOC   IBG,WRTCK4            STILL IN IBG
00021B 6215              BU    WRTCK                 GET NEXT WRITE TIME
00021C D840     WRTCK4   ANDM  TRACER,BORFLAG        HAS BOR BEEN UP YET
00021D 2024              BOC   DBUS,WRTCK7           BR IF NOT
00021E 9500              ORM   FLAGS,ZERO            IS THIS DIAG MODE
00021F 3015              BOC   DIAGWRT,WRTCK          BR IF SO
000220 1008              STOH  WORK1,DEVSEL          DROP MOVE BECAUSE
000221 5024              XFRH  WORK1,TUTAG           THIS IS A CREASE

                *                      ***** SET IBG DROP WHILE WRITING *****

000222 8C80              ORI   DTACHK1,IBGDROP       SET ERROR AND
000223 6215              BU    WRTCK                   HANG IN THERE
000224 A101     WRTCK7   ADD   WORK2,ONE             IS THE WAIT COUNT EXHAUSTED
000225 2115              BOC   NALCO,WRTCK           BR IF NOT

                *                      ***** SET SLOW BEGIN READ BACK CHECK *****      *

000226 8C04              ORI   DTACHK1,SLOWBGN       SET SLOW BEGIN RD BACK CHK. (DRIVE
000227 6215              BU    WRTCK                 RETURN TO GET WRITE TIME
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                 3170 *********************************************************************
                 3171 *  THIS SUBROUTINE IS USED IF BLOCK IS ACTIVE                        *
                 3172 *   NORMAL EXIT IS VIA WRTEND  AFTER WRITING ENDING 40 ZEROS.
                 3173 *   IF THE RECORD IS LONG ENOUGH (MORE THAN 240 CHAR) THEN AN
                 3174 *   EXIT IS TAKEN TO CHECK THE TACH VELOCITY
                 3175 *   THE NORMAL RETURN FROM TACH VELOCITY ROUTINE IS WRTCK 10
                 3176 *********************************************************************

000228 9800      3179 CHECKBOR ORM  TRACER,ZERO          IS THE 'BORFLAG' NON
000229 3131      3182          BOC  BORFLAG,CHKBOR1      BR IF SO
00022A A301      3185          ADD  WORK4,ONE            OTHERWISE COUNT ONE
00022B 21B9      3188          BOC  NALCO,CHKBOR2        BR IF NOT DONE YET
00022C 03F5      3191          STO  WORK4,ONES-10        SET NEW COUNT FOR 11
00022D 8840      3194          ORI  TRACER,BORFLAG       SET 'BORFLAG' - BLOCK LOOKS GOOD.
00022E 3631      3197 CHKBORO  BOC  WTMOP,CHKBOR1        BR IF WTM OP
00022F 2E31      3200          BOC  BOR,CHKBOR1          BR IF BOR OK

                 3203 *             ***** SET IBG DROP WHILE WRITING *****

000230 8C80      3206 DROPERR  ORI  DTACHK1,IBGDROP      SET ERROR IF NOT
000231 35B9      3209 CHKBOR1  BOC  FORFLAG,CHKBOR2      HAS FORCE BEEN SET-BR IF SO
000232 A301      3212          ADD  WORK4,ONE            OTHERWISE COUNT ONE
000233 21B9      3215          BOC  NALCO,CHKBOR2        BR IF NOT DONE YET
000234 8800      3218          ORI  TRACER,ZERO          IS THIS A WRITE TM OP
000235 3688      3221          BOC  WTMOP,TMADJCT        BR IF SO.
000236 4D42      3224 LPSETFOR XFR  XOUTAIM,XOUTA        SET FORCE AND NOLOSS TO DF
000237 8804      3227          ORI  TRACER,FORFLAG       SET FORCE DONE FLAG
000238 27B9      3230          BOC  STOP,CHKBOR2         DON'T GO CHECK VELOCITY IF STOP ON
000239 3AC3      3233          BOC  STATC,WRETURN5       GO TEST BLK, BOR, IBG---LWR OP

                 3236 *********************************************************************
                 3237 *  EXIT TO CHECK VELOCITY DURING REST OF THE RECORD
                 3238 *********************************************************************

00023A 6202      3241          BU   VELSTR               GO CHECK VELOCITY
00023B 9500      3244 WRTEND   ORM  FLAGS ZERO           IS THE INHIBIT POST AMBLE FLAG ON
00023C 3240      3247          BOC  INHPOST,MAXEND       BR IF SO
00023D 3A58      3250          BOC  STATC,RDCHK5         LWR--SKIP END CNT HERE
00023E A001      3253          ADD  WORK1,ONE            BUMP COUNTER FOR ENDING 40 ZEROS
00023F 2119      3256          BOC  NALCO,WRTCK2         BR IF NOT DONE
000240 0018      3259 MAXEND   STO  WORK1,ONES-228       SET MAX COUNT FOR ENDING

                 3262 *********************************************************************
                 3263 *   ENTRY POINT AFTER POSTAMBLE HAS BEEN WRITTEN TO RESET WRT COND   *
                 3264 *   NORMAL EXIT IS ENDATA ON WRITE OP OR AFTER FORCE COUNT
                 3265 *   HAS BEEN EXHAUSTED                                               *
                 3266 *                                                                    *
                 3267 *  ENTRY FOR WTM AFTER 64 CHAR WRITTEN TO RESET WRITE CONDITION      *
                 3268 *  AND WAIT FOR FORCE COUNT TO EXPIRE OR IF NOT WRITTEN PROPERLY     *
                 3269 *  EXHAUST COUNTER IN WORK1 AND EXIT.
                 3270 *********************************************************************

000241 C4BF      3273 WRTCKA   AND  STATIMG,ONES-PERMRDWT  STOP WRITING POSTAMBLE AND
000242 4428      3276          XFR  STATIMG,STAT         ALLOW WRITE CONDITION RESET
000243 3A71      3279          BOC  STATC,CHKCNT         LWR--BR ALL DONE TO CHECK ENDING
000244 1C45      3282          STO  LINK1,WRTCKB         SET RETURN FROM 'CHECKBOR'
000245 3847      3285 WRTCKB   BOC  WRTIME,WRTCKC        WAIT FOR NEXT
000246 6245      3288          BU   WRTCKB                WRITE TIME
000247 3847      3291 WRTCKC   BOC  WRTIME,WRTCKC        WAIT FOR WRT TIME TO FALL
00024B A001      3294          ADD  WORK1,ONE            COUNTER LOOKING FOR END DATA, IBG
                 3296 *                                  OR END OF TM (NOT SEEN AS BLOCK)
000249 214E      3298          BOC  NALCO,RDCHK1         BR IF OK
00024A 9800      3301          ORM  TRACER,ZERO          IS THIS WTM CMD
00024B 3692      3304          BOC  WTMOP,RDCHK3         BR IF SO

                 3307 *             ***** SET END DATA CHECK *****

00024C 1810      3310          STO  MPGMERR,ENDATAER     OTHERWISE SET END DATA CHK
00024D 6258      3313          BU   RDCHK5               GO TO END CHECKING
00024E 2859      3316 RDCHK1   BOC  ENDATA,RDCHK6        BR ON END DATA TO END CHECKING
00024F 3C28      3319          BOC  BLOCK,CHECKBOR       BR IF BLOCK DETECTED
000250 9800      3322          ORM  TRACER,ZERO          HAS THE BOR FLAG BEEN SET
000251 3145      3325          BOC  BORFLAG,WRTCKB       BR IF SO
000252 2F54      3328          BOC  IBG,RDCHK2           BR IF IBG DETECTED
000253 6245      3331          BU   WRTCKB               OTHERWISE TO GET NEXT WRITE TIME.
000254 A101      3334 RDCHK2   ADD  WORK2,ONE            COUNTER FOR TIME OUT LOOKING FOR 1ST
                 3336 *                                   OF BLOCK
000255 2145      3338          BOC  NALCO,WRTCKB         BR IF OK

                 3341 *             ***** SET SLOW BEGIN READ BACK CHECK *****

000256 8C04      3344          ORI  DTACHK1,SLOWBGN      SET SLOW BEGIN READ BACK (DRIVE)
000257 6245      3347          BU   WRTCKB               RETURN FOR NEXT CYCLE
000258 0000      3350 RDCHK5   STO  WORK1,0                  --CLEAR REG SO ONLY GET 40

                 3353 *********************************************************************
                 3354 *   ENTRY ON WRITE OP TO SET END COUNTS.                             *
                 3355 *  MUST HAVE SEEN 'ENDATA' OR EXHAUSTED COUNTER FOR 'ENDATA'-WORK1-  *
                 3356 *********************************************************************

000259 02DD      3359 RDCHK6   STO  WORK3,ONES-34        SET TO COUNT ENDING 40
00025A CDD7      3362          AND  XOUTAIM,ONES-FORCE-NOLOSS  TURN OFF FOR LATER
00025B A0D8      3365          ADD  WORK1,ONES-39        BUMP COUNT FOR ENDING TOTAL
                 3367 *********************************************************************
                 3370 ********************************************************************
                 3371 *  THE FOLLOWING SUBROUTINE:
                 3372 *  1.   ON WRITE COUNTS 35 BIT CELLS INTO ENDING 40 BURST AND       *
                 3373 *       RESETS FORCE AND NO LOSS. THEN WAIT UNTIL IBG COMES UP      *
                 3374 *  2.   WTM SHARES PART OF THE ROUTINE ALSO EXITS TO CHECK THE      *
                 3375 *       TM CONFIGURATION FOR 35 BIT CELLS AND THEN WAITS FOR IBG    *
                 3376 *  3.   LWR AND LWTM DO EITHER 1. OR 2. ABOVE AS APPLIES AND EXIT   *
                 3377 *       TO 'WRTCKA' TO RESET WRITE COND.                            *
                 3378 ********************************************************************

00025C 385C      3381 WRTRD      BOC   WRTIME,WRTRD         WAIT FOR WRT TIME TO FALL
00025D 1C6B      3384            STO   LINK1,RTRNBOR        SET RETURN FROM 'CHECKBOR'
00025E A001      3387 WRTRD10    ADD   WORK1,ONE            BUMP COUNTER LOOKING FOR IBG
00025F 2165      3390            BOC   NALCO,TESTBOR        BR IF NOT DONE
000260 2862      3393            BOC   ENDATA,WRTRD3        BR OUT ON ENDATA

                 3396 *                ***** SET END DATA CHECK *****

000261 1810      3399            STO   MPGMERR,ENDATAER     NO END DATA ON LWR
000262 3A41      3402 WRTRD3     BOC   STATC,WRTCKA         LWR--ALL DONE NOW GO SHUT OFF WR TGR
000263 8C02      3405            ORI   DTACHK1,SLOWEND      SET ERROR RECORD WAS TOO SLOW

                 3408 *                ***** SET SLOW END READ BACK CHECK *****

000264 6271      3411            BU    CHKCNT               ERROR EXIT TO CHECK COUNTS
000265 D840      3415 TESTBOR    ANDM  TRACER,BORFLAG       HAS A GOOD BLOCK BEEN SEEN
000266 2068      3418            BOC   DBUS,WRTRD1          BR IF NOT
000267 2F71      3421            BOC   IBG,CHKCNT           NORMAL EXIT
000268 9800      3424 WRTRD1     ORM   TRACER,ZERO          IS THIS A WTM CMD
000269 3689      3427            BOC   WTMOP,WRTRDTM        BR IF SO
00026A 3C28      3430            BOC   BLOCK,CHECKBOR       BR TO CHECK FOR GOOD RECORD
00026B A201      3433 RTRNBOR    ADD   WORK3,ONE            BUMP COUNTER TO RESET FORCE AND NO L
00026C 216F      3436            BOC   NALCO,WRTRD2         BR IF NOT
00026D A207      3439            ADD   WORK3,7              ADJUST COUNT TO EQUAL THE WRITE CNT
00026E 4D42      3442            XFR   XOUTAIM,XOUTA        SET IN REGISTER
00026F 385C      3445 WRTRD2     BOC   WRTIMF WRTRD         BR IF ON BACK TO COUNT ONE
000270 626F      3448            BU    WRTRD2               HANG IN LOOP

                 3451 ********************************************************************
                 3452 *  ENTRY USED ON NORMAL END OF WRITE OR WRITE TM OP TO
                 3453 *    CHECK THE RESIDUAL COUNTS AND ASSURE NORMAL COMPLETION
                 3454 ********************************************************************

000271 B030      3457 CHKCNT     ADDM  WORK1,48             COUNTER FROM STOP WRT TO ENDING IBG
000272 2180      3460            BOC   NALCO,FASTIBG        SHOULD NOT BR IF OK
000273 B128      3463 CHKSTR     ADDM  WORK2,40             COUNTER FROM START WRT TO IBG DROP
000274 2182      3466            BOC   NALCO,FASTSTR        SHOULD NOT BR IF OK
000275 B2FB      3469 CHKENDNG   ADDM  WORK3,ONES-4         COUNTER OF ENDING EITHER WTM OR WRT
000276 2179      3472            BOC   NALCO,CHKCNT2        SHOULD NOT BR IF OK
000277 B2E6      3475            ADDM  WORK3,ONES-25        COUNT SHOULD BE LESS THAN 26
000278 217A      3478            BOC   NALCO,ENDWREX        BR IF OK

                 3481 *                ***** SET EXCESSIVE OR INCORRECT POSTAMBLE *****

000279 8A02      3484 CHKCNT2    ORI   DTACHK2,EXCPOST      SET EXCESSIVE END CNT ON END 40 WRT
00027A 9800      3487 ENDWREX    ORM   TRACER,ZERO          HAS A BLOCK BEEN SEEN
00027B 317D      3490            BOC   BORFLAG,ENDWREX1     BR IF SO

                 3493 *                ***** SET NO BLOCK ON RECORD READ BACK CHECK *****

00027C 1D10      3496            STO   EQUIPCK,NBLOCK       SET NO BLOCK EQUIP CHK IF NOT
00027D 3A84      3499 ENDWREX1   BOC   STATC,LPRESET        BR IF LWR OR LWTM TO RESET INCORRECT
00027E 2FD0      3502 ENDWREX2   BOC   IBG,KRETURN1         WAIT UNTIL WE GET IBG
00027F 627D      3505            BU    ENDWREX1             THEN EXIT

                 3508 *                ***** SET EARLY END READ BACK CHECK *****

000280 8C08      3511 FASTIBG    ORI   DTACHK1,FASTEND      SET EARLY END RECORD RD CHK
000281 6273      3514            BU    CHKSTR               GO BACK

                 3517 *                ***** SET EARLY BEGIN READ BACK CHECK *****

000282 8C10      3520 FASTSTR    ORI   DTACHK1,FASTBGN      SET EARLY BEGIN RD CHK
000283 6275      3523            BU    CHKENDNG             GO BACK

                 3526 ********************************************************************.
                 3527 *  THE ERRORS ARE RESET WHETHER OR NOT THEY WERE SET-ONLY LWR,LWTM-  *
                 3528 *  THEY ARE 'EARLY BEGIN AND END CHECK' AND 'SLOW BEGIN AND END     *
                 3529 *  CHECK, AND EXCESSIVE POSTAMBLE.                                  *
                 3530 ********************************************************************

000284 CCE1      3533 LPRESET    AND   DTACHK1,ONES-X'1E'   RESET-- EARLY AND SLOW CHECKS
000285 CAFD      3536            AND   DTACHK2,ONES-X'02'    RESET--EXCESSIVE POSTAMBLE
000286 1D00      3539            STO   EQUIPCK,0            CLEAR EQUIP CHKS
000287 627E      3542            BU    ENDWREX2

                 3545 ********************************************************************
                 3546 *   USED ON READ CHECK OF WTM TO TEST FOR CORRECT CONDITIONS
                 3547 *   OF TAPE MARK
                 3548 ********************************************************************

000288 A0F5      3551 TMADJCT    ADD   WORK1,ONES-10        ADJUST COUNT TO EQUAL THE WRITE CNT
000289 A201      3554 WRTRDTM    ADD   WORK3,ONE            INCREMENT COUNTER
00028A 218D      3557            BOC   NALCO,WRTRDTM1       GO CHECK TAPE MARK
00028B 3A96      3560            BOC   STATC,SETMRTN        LWTM--BR IF LOOP WTM
00028C 8808      3563            ORI   TRACER,NTMTEST       SET FLAG ALL DONE TESTING FOR TM
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00028D 9800      3566 WRTRDTM1 ORM   TRACER,ZERO          SET FOR TEST
00028E 346F      3569          BOC   NTMTEST,WRTRD2       BR IF 'DON'T TEST FLAG ON'

00028F 306F      3573          BOC   TM,WRTRD2            BR IF TAPE MARK DET

                 3576 *              ***** SET WRITE TM ERROR *****

000290 8A20      3579 SETMERR  ORI   DTACHK2,WTMERR       SET WRITE TAPE MARK CHECK ON
000291 626F      3582          BU    WRTRD2               GO BACK GET NEXT ONE

                 3585 *******************************************************************
                 3586 *  USED FOR ERROR DETECTION - EITHER SET 'WTMERR' WHICH IS DATA     *
                 3587 *  CHECK OR 'TMNBLK' EQUIPMENT CHECK.                               *
                 3588 *******************************************************************

000292 9800      3591 RDCHK3   ORM   TRACER,0             HAS BLOCK BEEN DETECTED
000293 3190      3594          BOC   BORFLAG,SETMERR      BR IF SO TO SET ERROR

                 3597 *              ***** SET WTM NOT DETECTED BLOCK *****

000294 1D08      3600 RDCHK4   STO   EQUIPCK,TMNBLK       SET EQUIP CHECK NO BLOCK DETECTED
000295 627D      3603          BU    ENDWREX1             SO TO EXIT

                 3606 *******************************************************************
                 3607 *  USE TO SET ENDING COUNT ON LWTM CWD.
                 3608 *******************************************************************

000296 00F3      3611 SETMRTN  STO   WORK1,ONES-12        THIS THE END COUNT BEFORE DROP WR
000297 1C41      3614          STO   LINK1,WRTCKA         RETURN TO RESET PERMRDWT
000298 62A9      3617          BU    CNTL                 AFTER COUNT END
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(Omitted Nonpertinent Coding)

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                 4288 ************************* SCAN FOR DEVICE ENDS ***********************
                 4289 * SEARCH FOR DEV ENDS REQUIRES MAXIMUM COMMUNICATION BETWEEN THE TWO  *
                 4290 * ALUS.  ALU2 SEARCHS HIS DEPRIME REGS FOR BITS. WHEN HE FINDS ONE,   *
                 4291 * THE ADDRESS IS PASSED TO ALU1 VIA XOUTB AND A WAIT IS INITIATED     *
                 4292 * WHILE ALU1 SELECTS THE DEVICE. WHEN ALU1 HAS THE DEVICE SELECTED,   *
                 4293 * ALU2 IS KICKED OFF TO DETERMINE THE DEVICE  STATUS. IF A LIVE DEV   *
                 4294 * END IS FOUND,ALU2 AGAIN RETURNS TO ALU1 WITH STAT C ON              *
                 4295 *          IF NO DEV END IS FOUND FOR THAT DEVICE, A DIFFERENT ADDRESS *
                 4296 * WILL BE PLACED IN XOUTB (NEXT POSSIBLE DE).WHEN ALU2 RETURNS TO ALU1*
                 4297 * AFTER RUNNING  OUT OF DE PRIMES,STATD WILL BE SET.                  *
                 4298 *                                                                     *
                 4299 *         ALU1 STATS                         ALU2 STATS               *
                 4300 *         A                                  A                        *
                 4301 *          B INTERFACE B                      B DE PRIME FOUND - WAIT *
                 4302 *           C STEP ALU2                        C DEVICE FREE          *
                 4303 *            D                                  D FINISHED            *
                 4304 *                                                                     *
                 4305 *                                                                     *
                 4306 ***********************************************************************

00034D 0100      4309 EXECPOLL STO   WORK2,0              CLEAR LSR TO HOLD TU ADDR
00034E 1200      4312          STOH  WORK3,0              CLEAR FLAG
00034F 0B01      4315 EXECPULL STO   TUADDR,1             SET UP TUADDR LSR
000350           4317 POLL1    EQU   *
000350 4F21      4319          XFR   LODEPB,AR            DO WE HAVE A DEV END B           MIS*
000351 2B54      4322          BOC   STATB,POLL3          SKIP                             MIS*
000352 9000      4325          NOP1                       RESET AR                         MIS*
000353 4E21      4328 POLL2    XFR   LODEPA,AR            DO WE HAVE A DEV END A
000354 DBC0      4331 POLL3    ANDM  TUADDR,0             DREG NOT ZERO SAYS DEV END
000355 2080      4334          BOC   DBUS,POLLNEXT        BR IF NOT
000356 4141      4337 POLL10   XFR   WORK2,XOUTB          SEND DEV ADDRESS RO ALU1
000357 8404      4340          ORI   STATIMG,SETSTATB     TELL ALU1
000358 442B      4343          XFR   STATIMG,STAT         SET STAT B

                 4346 ***********************************************************************
                 4347 *  WARNING  DO NOT SINGLE STEP THROUGH NEXT INSTRUCTIONS IF MORE THAN *
                 4348 *  ONE PRIME
                 4349 ***********************************************************************
000359 3A59      4351 WTEONC   BOC   STATC,WTEONC         WAIT FOR STATC TO GO OFF
00035A 3A5G      4354 POLL4    BOC   STATC,POLI5          WAIT FOR ALU1
00035B 635A      4357          BU    POLL4                  STAT C TO COME ON
00035C C4FB      4360 POLL5    AND   STATIMG,ONES-SETSTATB
00035D 442B      4363          XFR   STATIMG,STAT         TRN OFF STAT B
00035E 3E7D      4366          BOC   BSYTACH,POLLSTEP     BR IF SWITCHED

                 4369 ***********************************************************************
                 4370 * GO SEE IF DEVICE IS PULSING - IF SO DO NOT PRESENT DEV END          *
                 4371 ***********************************************************************

00035F 1C3A      4374          STO   LINK1,PRETURN2       SET FOR PULSE RET-POLLSTEP
000360 193B      4377          STO   LINK2,PRETURN4       SET FOR NO PULSE RET-GOGETIM
000361 612B      4380          BU    CHKPULSE
000362 1CD7      4383 GOGETIM  STO   LINK1,SRETURN3       RETURN TO POLL6
000363 60C0      4386          BU    ECHSTS               GO GET SNS BYTES
000364 3E7D      4389 POLL6    BOC   BSYTACH,POLLSTEP
000365 D604      4393 POLLALL  ANDM  SENSE1,START         IS TR RDY
000366 2068      4396          BOC   DBUS,DRVUNICK        BR IF NOT
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000367 8404          4399 DEVDONE  ORI    STATIMG,SETSTATB          WE HAVE A LIVE DEV END
000368 8402          4402 DRVUNICK ORI    STATIMG,SETSTATC        SET STATC ON NOT READY COND.
000369 4428          4405 XFRSTAT  XFR    STATIMG,STAT            TELL ALU1
00036A               4407 POLLMTIX EQU    *                       GO WAIT TO RESET THE DEV END
00036A 3B6C          4409          BOC    STATD,DOINDE            IS STATD ON
00036B 636A          4412          BU     POLLMTIX                WAIT FOR IT

                     4415 **********************************************************************
                     4416 * IF THE TAPE UNIT INTERRUPT IS ON - TAPE WILL BE ISSUED A RESET       *
                     4417 * ON GO AHEAD FROM ALU1,THE DEVICE END PRIME WILL BE RESET             *
                     4418 **********************************************************************

00036C 00FF          4421 DOINDE   STO    WORK1,ONES              SET MASK TO GET
00036D 4B21          4424          XFR    TUADDR,AR                ONES COMPLEMENT
00036E E000          4427          XO     WORK1,0                   OF THE ADDR
00036F 4021          4430          XFR    WORK1,AR                   TO RESET THE PRIME
000370 2B73          4433          BOC    STATB,FINDTU7           BR IF INTERFACE B              MIS*
000371 CE00          4436          AND    LODEPA,0                TRN OFF DEV END A
000372 6374          4439          BU     FINDTU77                ALL DONE AND RESET ALL STATS
000373 CF00          4442 FINDTU7  AND    LODEPB,0                TRN OFF DEV END B              MIS*
000374 3F78          4445 FINDTU77 BOC    DEVATTN,RESETTU         BR IF MTI ON
000375 5221          4448 POLLSTOP XFRH   WORK3,AR                PUT FLAG
000376 8400          4451          ORI    STATIMG,0                INTO
000377 61D9          4454 SNSTOP   BU     SETD                      STAT REG
000378 100A          4458 RESETTU  STOH   WORK1,DEVSEL+COMMAND     RESET
000379 1102          4461          STOH   WORK2,RESET                  OUTSTANDING
00037A 5024          4464          XFRH   WORK1,TUTAG                 TAPE UNIT
00037B 5160          4467          XFRH   WORK2,TUBO                  INTERRUPT
00037C 61BC          4470          BU     EXECABRT
00037D 1204          4473 POLLSTEP STOH   WORK3,SETSTATB          SET FLAG (HOLD INTERFACE)
00037E 1900          4476 SKIPB    STO    LINK2,0                 CLEAR DEVICE
00037F 5924          4479          XFR    LINK2,TUTAG              SELECT
000380 A101          4483 POLLNEXT ADD    WORK2,1                 BUMP TU ADDR BY 1
000381 4B21          4486          XFR    TUADDR,AR               BUMP TU ADR BY 1
000382 AB00          4489          ADD    TUADDR,0                  BY PROPAGATION
000383 2150          4492          BOC    NALCO,POLL1             BR TO DO NEXT DEV
000384 2A75          4495          BOC    STATA,POLLSTOP          BR OUT ON 2ND PASS
000385 8408          4498          ORI    STATIMG,SETSTATA        TRN ON STAT A ON FIRST PASS
000386 4428          4501          XFR    STATIMG,STAT              TO ALLOW BR ON SECOND PASS
000387 5006          4504          XFRH   LSR                     SET HI
000388 0108          4507          STO    WORK2,8                 TRN ON HIGH ORDER SEL BIT
000389 634F          4510          BU     EXECPULL                GO RUN 2ND PASS
                     4514 **************************** SENSE ROUTINE ***************************
                     4515 *                                                                    *
                     4516 *  THIS ROUTINE WILL ASSEMBLE AND PRESENT TO ALU1 THE SENSE BITS FROM *
                     4517 *  ALU2 AND/OR THE DRIVE.                                            *
                     4518 *  THE SENSE BITS WILL BE PRESENTED IN XOUTA OR XOUTB IN THE PROPER  *
                     4519 *  POSITION TO BE OR'ED INTO THE CONTROL UNIT SENSE BYTE.            *
                     4520 **********************************************************************
00038A C504          4522 SNS3     AND    FLAGS,LWROP             RESET ALL BITS EXCEPT LWR
00038B 5D21          4525          XFR    EQUIPCK,AR                EQUIPMENT CHECKS
00038C 3400          4528          ORM    STATIMG,0               ARE ANY EQUIPMENT ERR SET
00038D 208D          4531          BOC    DBUS,SNS4               BR IF NOT
00038E 8110          4534          ORI    WORK2,EQCHK             SET EQUIP CHECK ON
00038F 8508          4537          ORI    FLAGS,UDETERR           SAVE IN FLAGS REG IF SO.
000390 DAFF          4540 SNS4     ANDM   DTACHK2,ONES-FORMATCK  DO NOT DET DC ON FORMATCK
000391 2093          4543          BOC    DBUS,SNS41              BR IF NO DATA CKS IN REG
000392 6398          4546          BU     SNS42                   GO SET DATA CK ON

000393 4021          4550 SNS41    XFR    DTACHK1,AR              LOOK FOR
000394 5821          4553          XFR    MPGMERR,AR                ANY
000395 8400          4556          ORI    STATIMG,ZERO                DATA
000396 04FE          4559          ANDM   STATIMG,X'FE'                 CHECKS
000397 209A          4562          BOC    DBUS,SNS5               BR IF NO DATA CHECKS
000398 9108          4565 SNS42    ORI    WORK2,DATACK            SET DATA CHECK ON
000399 8508          4568          ORI    FLAGS,UDETERR           SAVE IN FLAGS REG IF SO.
00039A 299C          4571 SNS5     BOC    NCONVCK,SNS6            BR IF NOT DATA CONVERTER CHECK
00039B 8101          4574          ORI    WORK2,CONVCK            SET THE ERROR

00039C D780          4578 SNS6     ANDM   SENSE2,SEVTRK           IS THIS 7 TRK DR.
00039D 209F          4581          BOC    DBUS,SNS7               BR IF NOT
00039E 8210          4584          ORI    WORK3,SEVENTRK          SET ON IF SOCU
00039F D610          4587 SNS7     ANDM   SENSE1,BOT              IS THIS BEGIN OF TAPE DR
0003A0 20A2          4590          BOC    DBUS,SNS8               BR IF NOT
0003A1 8208          4593          ORI    WORK3,LDPT              SET LOAD POINT ON CU
0003A2 D608          4596 SNS8     ANDM   SENSE1,WRSTAT           IS WRITE STATUS ON DR
0003A3 20A5          4599          BOC    DBUS,SNS9               BR IF NOT
0003A4 8204          4602          ORI    WORK3,WRSTA             SET ON IF SO.  CU
0003A5 9600          4605 SNS9     ORM    SENSE1,ZERO             IS DRIVE FILE PROTECTED
0003A6 31A8          4608          BOC    NFP,SNSB                 BR IF NOT
0003A7 8202          4611          ORI    WORK3,FP                SET FILE PROTECT ON
0003A8 19AA          4614 SNSB     STO    LINK2,SNSC              RETURN TO SNSC
0003A9 63EC          4617          BU     SNSWAIT                 GO SEND BYTES 0 AND 1
                     4620 *  SENSE BYTE 2 AND 3

                     4623 SNSC     STO    WORK3,ENDATAER          SET UP MASK FOR END DATA CHK
0003AA 0210          4626          XFR    MPGMERR,AR              SET REG TO AR TO TEST AND
0003AB 5821          4629          AND    WORK3,ZERO              IF ON WILL REMAIN ON
0003AC C200          4632          ORM    SENSE2,ZERO             IS UNIT NOT PHASE ENCODED DR
0003AD 9700          4635          BOC    NOTPE,SNSD              BR IF SO (NRZI)
0003AE 33B0          4638          ORI    WORK3,PE                SET PE ON CU
0003AF 8204          4641 SNSD     ANDM   SENSE1,BACKWD           IS UNIT BACKWARD DR
0003B0 D680          4644          BOC    DBUS,SNSE               BR IF NOT
0003B1 20B3          4647          ORI    WORK3,BKWD              SET ON IF SO CU
0003B2 8202          4650 SNSE     STO    LINK2,SNSF              RETURN TO SNSF
0003B3 19B5
0003B4 63EC          4653          BU     SNSWAIT                 GO SEND BYTES 2 AND 3
```

```
                4656 *  SENSE BYTE 4 AND 5

0003B5 C622     4659 SNSF      AND   SENSE1,EOT+DEVCHK  CLEAR ALL BITS BUT THESE TWO
0003B6 0140     4662           STO   WORK2,REJTU        SET MASK IN REG
0003B7 5021     4665           XFR   EQUIPCK,AR         PUT EQUIPMENT CHK ON AR
0003B8 C100     4668           AND   WORK2,ZERO         AND MASK AND AR
0003B9 4621     4671           XFR   SENSE1,AR          PUT BITS
0003BA 4521     4674           XFR   FLAGS,AR            ON AR TO
0003BB 8100     4677           ORI   WORK2,ZERO           PASS TO REG
0003BC 19BF     4680           STO   LINK2,SNSG         RETURN TO SNSG
0003BD 4A21     4683           XFR   DTACHK2,AR         PUT REG IN AR
0003BE 63EB     4686           BU    POSBYTE             GO SET IN WORK3

                4689 *  SENSE BYTES 6 AND 7

0003BF 4742     4692 SNSG      XFR   SENSE2,XOUTA       PASS REG TO XOVER
0003C0 19C3     4695           STO   LINK2,SNSH         RETURN TO SNSH
0003C1 1CD8     4698           STO   LINK1,SRETURN4     RETURN TO SNSLINK
0003C2 60C5     4701           BU    FCHSNS             GO PULL 2 BYTES OF SENSE
0003C3 19C6     4704 SNSH      STO   LINK2,SNSJ         SET RETURN TO SNSJ
0003C4 4641     4707 SNSI      XFR   SENSE1,XOUTB       PASS SENSE 1 TO XOVER
0003C5 63EE     4710           BU    WAITO              GO FINISH

                4713 *  SENSE BYTES 8 AND 9

0003C6 4C42     4716 SNSJ      XFR   DTACHK1,XOUTA      PASS ERROR REG TO XOVER
0003C7 8240     4719           ORI   WORK3,EXVCHG       SET MASK IN REG
0003C8 5821     4722           XFR   MPGMERR,AR         PUT ERROR REG ON AR
0003C9 C200     4725           AND   WORK3,ZERO         AND MASK AND AR
0003CA 19CC     4728           STO   LINK2,SNSK         SET RETURN TO SNSK
0003CB 63ED     4731           BU    WAIT4              GO FINISH

                4734 *  SENSE BYTES 10 AND 11

0003CC 018F     4737 SNSK      STO   WORK2,ONES-REJTU   SET MASK IN REG
0003CD 5021     4740           XFR   EQUIPCK,AR         PUT ERROR REG ON AR
0003CE C100     4743           AND   WORK2,ZERO         AND MASK AND AR
0003CF 19D1     4746           STO   LINK2,SNSL         RETURN TO SNSL
0003D0 63FC     4749           BU    SNSWAIT            GO PASS TO X OVERS

                4752 *  SENSE BYTES 12 AND 13

0003D1 19D3     4755 SNSL      STO   LINK2,SNSM         RETURN AFTER SENDING
0003D2 63FC     4758           BU    SNSWAIT              2 BLANK BYTES

                4761 *  SENSE BYTES 14 AND 15

0003D3 19D6     4764 SNSM      STO   LINK2,SNSO         RETURN TO SNSO
0003D4 4721     4767 SNSN      XFR   SENSE2,AR          GET TU SERIAL NO-HIGH
0003D5 63EB     4770           BU    POSBYTE            GO FINISH

                4774 *  SENSE BYTES 16 AND 17

0003D6 19D8     4777 SNSO      STO   LINK2,SNSP         RETURN TO SNSP
0003D7 60C5     4780           BU    FCHSNS             PULL 2 BYTES FROM DRIVE
0003D8 4642     4783 SNSP      XFR   SENSE1,XOUTA       PASS TU SERIAL NO.-LOW
0003D9 19DB     4786           STO   LINK2,SNSQ         RETURN TO SNSQ
0003DA 63ED     4789           BU    WAIT4              GO FINISH

                4792 *  SENSE BYTES 18 AND 19

0003DB 19E1     4795 SNSQ      STO   LINK2,SNSR         RETURN TO SNSS
0003DC 4742     4798           XFR   SENSE2,XOUTA       PASS SENSE2 TO X OVER
0003DD 4F41     4801           XFR   LODEPB,XOUTB        PASS DEV END PRIMES LOW INTF B
0003DE 2BEE     4804           BOC   STATB,WAITO        BE IF B INTERFACE
0003DF 4E41     4807           XFR   LODEPA,XOUTB       PASS DEV END PRIMES LOW INTF A
0003E0 63EE     4810           BU    WAITO              GO FINISH

                4813 *  SENSE BYTES 20 AND 21

0003E1 19E3     4816 SNSR      STO   LINK2,SNSS         RETURN TO SNSS
0003E2 60C5     4819           BU    FCHSNS             GO GET THE LOAD AND THREAD BYTE
0003E3 19E9     4822 SNSS      STO   LINK2,SNSV         RETURN TO SNSV
0003E4 4741     4825 SNST      XFR   SENSE2,XOUTB       PASS DRIVE LOAD BYTE TO XOVER
0003E5 5F42     4828           XFRH  LODEPB,XOUTA       PASS DEV END PRIMES HI INTF B
0003E6 2BEE     4831           BOC   STATB,WAITO        BR IF B INFT
0003E7 5E42     4834           XFRH  LODEPA,XOUTA       PASS DEV END PRIMES 8-15 INTF A
0003E8 63EE     4837           BU    WAITO              GO FINISH

                4840 *  SENSE BYTES 22 AND 23

0003E9 19F9     4843 SNSV      STO   LINK2,DALONE       WHEN RETURN MADE SET STAT D
0003EA 4921     4846           XFR   FRU,AR             SET UP TO PASS EM

0003EB 8200     4850 POSBYTE   ORI   WORK3,ZERO         PUT THE AR INTO WORK3
                4852 ***************************************************************
                4853 *  USE THIS SUBROUTINE TO SEND 2 BYTES TO ALU1                  *
                4854 ***************************************************************

0003EC 4142     4857 SNSWAIT   XFR   WORK2,XOUTA        PASS BYTE TO ALU1
0003ED 4241     4860 WAIT4     XFR   WORK3,XOUTB        PASS BYTE TO ALU1
0003EE 0402     4863 WAITO     STO   STATIMG,SETSTATC   TURN ON STATC
0003EF 4428     4866           XFR   STATIMG,STAT        FOR ALU2
0003F0 3BF3     4869 WAIT1     BOC   STATD,WAIT5        WHEN D COMES ON GO
0003F1 27F9     4872           BOC   STOP,DALONE        BR IF STOP IS ON
0003F2 63F0     4875           BU    WAIT1               GET NEXT SENSE BYTES
```

```
0003F3 5428         4878 WAIT5     XFRH   STATIMG,STAT        CLEAR STATS
0003F4 27F9         4881 WAIT2     BOC    STOP,DALONE         BR IF STOP IS ON
0003F5 3BF4         4884           BOC    STATD,WAIT2         WAIT UNTIL STATD GOES OFF.
0003F6 0100         4887 SNSLINK   STO    WORK2,ZERO          CLEAR XOUTB INPUT REG
0003F7 0200         4890           STO    WORK3,ZERO          CLEAR XOUTA INPUT REG
0003F8 5922         4893           XFR    LINK2,IC             RETURN VIA LINK
0003F9 6011         4896 DALONE    BU     SETDLONE             GO SET STAT D
```

(Omitted Nonpertinent Coding)--.

TESTING STACKABLE DEVICE STATUS

This section describes three tests in simplified flowchart form using the BLK INT FLG set forth in the microprogram flowchart. The first portions D1 and D2 set up the various tests. Test **1**, steps **D3–D10**, concurrently tests stackable DVE STS for all devices attached to a given CU. Test **2**, steps **D11** through **D16**, tests the ability of a CU to maintain stackable status while performing other commands. Test **3**, steps **D17–D24**, concurrently tests pending DVE STS on an SIO.

The below flowchart represents a program within a CPU connected to the CU having the microprogram flowcharted above.

Setup Tests

PROGRAM STEP D1

Function: Set DX to SIO. The address X of the first device to be tested for stackable status is set in an SIO instruction to be sent to a channel processor.

PROGRAM STEP D2

Function: SET DIAGNOSE and its CCW. The BLK INT FLG is set, together with the chaining flag. The chaining flag causes the channel processor to supply SUPPRO upon each STATIN from CU.

Test **1** — Check Stackable DE's

This concurrent test verifies CU's ability to stack DEVICE END indications.

PROGRAM STEP D3

Function: Issue SIO instruction including issuing SET DIAGNOSE and its CCW.

PROGRAM STEP D4

Function: Cause I/O OP to be executed.

PROGRAM STEP D5

Function: Increment X to next address.

PROGRAM STEP D6

Function: Determine whether X=K, where K is a number of devices. If not, return to D3; if yes, continue to D7.

PROGRAM STEP D7

Function: SET DIAGNOSE instruction with CCW resetting BLK INT and resetting chain flag. This operation is preparing to complete the diagnostic operation enabling the CU to return to data processing functions.

PROGRAM STEP D8

Function: Issue SIO with SET DIAGNOSE set up in **D7**. Issue a command to the I/O program "wait."

THE WAIT MACRO

This is a macroinstruction used in OS **360** and OS **370** with regard to supervising a task, in this case, an OLT function having a subtask performed by IOS. The control program has a task control buffer (TCB) for each task in the system including the diagnostic task. The TCB has identification of the location of core storage areas allocated to such tasks. Once control has passed from the control program to the task, i.e., OLTEP or OLT, the task management programs in OLTEP keep track of the task current state. Such current state depends upon the readiness of the task program (OLT, in this case) to use the CPU. If such OLT can make immediate use of a CPU, it is READY. While it is actually using the CPU, the task is ACTIVE. The other state is WAIT. During the WAIT state, the task is inactive because more information is required from the I/O subsystem, for example. In this particular instance, the task must wait until all DE's are received from the I/O subsystem being diagnosed. The completed use of a resource, i.e., all DE's have been received, the appropriate resource manager takes control. The OLT will get control of the CPU only if higher priority tasks have been performed. Tasks controlled by initiator/terminator programs are well understood with respect to OS **360** and are not further described.

PROGRAM STEP D9

Function: This step is entered after the WAIT macro has been satisfied. The step checks to see whether or not DE's were received from all activated devices. If yes, the OLT is completed. If no, step **D10** is performed.

PROGRAM STEP D10

Function: This step causes a printout of the error in that not all DE's were received. Additionally, errors may be logged in outboard data recorder (ODR) for later analysis. ODR is a programmed data log keeping operational status.

Test **2** - Concurrent Testing of Maintaining Stackable Status While Subsystem Performs Another Command

This test initiates operation to the CU in the first device. It then initiates a second operation in a second device having an extended time duration such as read/-write in the burst mode. It then checks for a DE upon completion of the BURST command from the first device to see whether or not the CU stacked the DE. If it was not stacked, an error is logged.

Program steps D1 and D2 are the same except that chained instructions are different. A BURST command such as read or write, plus a control command (rewind, space OP, etc.), is performed while maintaining the BLK INT flag. This test also exercises the subsystem in an intermix situation, i.e., two devices are doing two different functions at the same time.

PROGRAM STEP D11

Function: An SIO channel command is issued followed by a SET DIAGNOSE set up in accordance with D2. Chaining is initiated.

PROGRAM STEP D12

Function: A BURST (another) command is sent to the subsystem chained to a control command on a different device.

PROGRAM STEP D13

Function: A second SIO channel command followed by a SET DIAGNOSE which resets the BLK INT FLG.

PROGRAM STEP D14

Function: In response to D13, was a CUB signal received? If yes, exit test; if no, proceed to D15.

PROGRAM STEP D15

Function: Test for DE from addressed MTU or I/O device. If DE was received, exit test. Note: A DE should be received when CUB is no. If no DE or no CUB, proceed to D16.

PROGRAM STEP D16

Function: Print detected error condition and log same within CPU for further analysis. Exit OLT.

Test 3 — Concurrent Test on Maintaining Stackable Status While Performing a Second Command

This test, by sensing for either a BUSY or DE in an SIO following a previous SIO initiating a command, concurrently tests pending DE status in the addressed CU. The test can be performed for each device; however, it is primarily a test directed toward response of a CU. BLK INT blocks SUPPRI when CU responds to a second SIO from the channel. The status resulting from the first SIO should be stored (stacked) in CU during the performance of the second SIO. This concurrent test verifies that ability.

PROGRAM STEP D17

Function: Issue SIO SET DIAGNOSE with BLK INT active as set up in D2.

PROGRAM STEP D18

Function: Initiate a command function in CU with regard to device having address X.

PROGRAM STEP D19

Function: Increment address X by 1.

PROGRAM STEP D20

Function: Issue (READ from or RECORD on tape) command to device X+1.

PROGRAM STEP D21

Function: Issue SIO to CU with SET DIAGNOSE resetting BLK INT.

PROGRAM STEP D22

Function: Issue WAIT macro to IOS for receiving DE from device X.

PROGRAM STEP D23

Function: Check for received DE using a timeout in accordance with the length of the issued BURST command to device X+1. Go to step D24 if no DE is received; otherwise, exit Test 3 returning CPU to OS.

PROGRAM STEP D24

Function: The error is printed and logged for further error analysis by other programs.

Test 4 — Concurrent Testing Ending Control Unit End (CUE) Status on SIO (c1–C8)

This tests the capability of a CU to send a CUE upon receipt of an SIO channel command.

PROGRAM STEP C1

Function: Set a device address into an SIO instruction. SET DIAGNOSE instruction with a CCW having a BLK INT and chain a FILE OP to SET DIAGNOSE.

PROGRAM STEP C2

Function: Send SIO to CU for device DX.

PROGRAM STEP C3

Function: Send SIO FILE OP for device X.

PROGRAM STEP C4

Function: Test for CUB. If no CUB (FILE OP was not executed), print an error. If CUB is received, proceed to step C5.

PROGRAM STEP C5

Function: Time out FILE OP. At end of time out, proceed to C6.

PROGRAM STEP C6

Function: Send a second SIO to CU for device X+K, where X is the device doing the FILE OP and K is a constant for addressing a second I/O device. Then, check for responses in steps C7 and C8.

PROGRAM STEP C7

Function: Check for CUB. If CUB is received, exit test as everything is operating O.K. If no CUB, proceed to step C8.

PROGRAM STEP C8

Function: Test for CUE. If CUE has been received, exit normally. If it has not been received and CU is not busy (CUB = 0), an error should be logged since a CUE should be sent upon completion of FILE OP. Note: BLK INT being blocked permits the second and third SIO's to be performed by the CU and enables sending CUB and CUE to initiating channel for diagnostic purposes.

In a variation of the above flowcharted test, a CUB test can be performed before the FILE OP is timed out in C5. This would be an independent test of CUB.

Then, after timing out the FILE OP, the test will include a CUE test; hence, testing both CUB and CUE. Additionally, a test for DE can be provided after receiving a CUE. If the DE is not received from device X, then an error is logged.

Test 5 - Concurrent Checking Nonstackable Status (C10–C21)

In an I/O subsystem using MTU's, there are two types of status—stackable and nonstackable. Stackable status is status that can be held by the control unit while performing operations on other devices. Nonstackable status is that status that must be accepted by the CPU before another operation is initiated on the CU. Accordingly, it is important for CU to maintain nonstackable status until it is accepted by the CPU. This concurrent test tests such ability.

PROGRAM STEP C10

Function: Set device address X into an SIO instruction. Chain it to a SET DIAGNOSE with a CCW having its BLK INT FLG active. Set chaining.

PROGRAM STEP C11

Function: Issue SIO instruction with chained SET DIAGNOSE. Rewind an MTU to beginning of tape (BOT). Write one record on the tape by issuing a burst write to stop the tape. With BLK INT on, issue a backspace record (BSR). This moves tape between the first record and load point. Issue a second BSR. As a result of second BSR, CU should issue a CUE, DE, UC. With BLK INT active, UC will not be supplied to channel with the pending nonstackable status (tape is at load point and should not receive a BSR). If another MTU is addressed and was an SIO, a CUB should be received since the CU cannot complete its operation.

PROGRAM STEP C12

Function: Issue SIO to device address X+K, where K is a constant.

PROGRAM STEP C13

Function: Was a CUB received from the CU? If yes, a response has been received; proceed to **C15**. If no, log an error in **C14**.

PROGRAM STEP C14

Function: Log error detected in step **C13**.

PROGRAM STEP C15

Function: Issue a second SET DIAGNOSE channel command with a CCW resetting BLK INT.

PROGRAM STEP C16

Function: Issue a WAIT macro for device X in order to receive the status generated in step C11.

PROGRAM STEP C17

Function: Was appropriate status received, i.e., CUE, DE, and UC? Note: BLK INT is now erased and UC will be transferred to channel. If yes, proceed to step **C19**; if no, proceed to **C18**.

PROGRAM STEP C18

Function: Log an error based upon improper response. Note: All three responses should be received; otherwise, an error will be logged. The absence of one of the three will indicate the location of the error in the CU.

PROGRAM STEP C19

Function: Issue SIO's to device X and device X+K. At this time, both devices should be available to the CPU.

PROGRAM STEPS C20 and C21

Function: Check whether devices X and X+K are busy. If either or both are busy, log an appropriate error. If neither are busy, exit the test.

Test 6 — Concurrent Testing of Enable/Disable With and Without Pending Device Status (C30–C37)

On some I/O subsystems, there is a manually actuable enable/disable switch. When the switch is in the enable position, operations with the connected data processing system are enabled. When the switch is in the disabled position, only off-line operations are permitted with all signal transfers to and from the data processing system being inhibited. The present test provides for concurrent testing of the enable/disable switch and its effect on pending status. An operator must intervene for actuating :he enable/disable switch in accordance with instructions printed out at the operator's console.

PROGRAM STEP C30

Function: Perform steps D1–D6 of the above flowchart. This stacks DE status within the CU being diagnosed. Note: BLK INT is active.

PROGRAM STEP C31

Function: Print "drop enable" in the operator's console for an operator to switch the enable/disable switch to the disable position.

PROGRAM STEP C32

Function: Send SIO to the CU just disabled along with SET DIAGNOSE with a CCW BLK INT. This program step will not be initiated until after the operator has verified the enable/disable switch has been set to the disable position. The OLT will be keyed to a console input interrupt.

PROGRAM STEP C33

Function: Verify that the I/O subsystem appeared to be off-line. If it went off-line, an error condition occurs. The I/O subsystem must remain on-line until all stacked status has been reported to CPU. If the I/O subsystem is still enabled, as it should be, step C34 is entered without logging an error.

PROGRAM STEP C34

Function: Send SIO with a SET DIAGNOSE with the CCW resetting BLK INT.

PROGRAM STEP C35

Function: Reset all DE's in CU. This is cleared by the channel receiving all of the DE's.

PROGRAM STEP C36

Function: Supply another SIO to the I/O subsystem. The response should be from the channel processor that the I/O subsystem is now off-line. If it is not off-line, an error should be logged. In either event, proceed to step C37.

PROGRAM STEP C37

Function: Print out "set enable" to the operator's console and exit the test. The above flowchart verifies operation of the enable/disable switch, both with pending status when the I/O subsystem is not allowed to go off-line and when there is no pending status such that the I/O subsystem should go off-line upon setting the switch to the disable position.

Test 7 — Concurrent Test of all DVE BSY's on a Simultaneous Basis

This test actuates all devices on a free-standing operation such as rewind, after all the MTU's are in a rewind condition. An SIO is issued to all devices, with a busy signal being received from all of them if the operation is proper. BLK INT is necessary in order to obtain the DVE BSY signal.

PROGRAM STEP C40

Function: The test is set up in accordance with steps D1–D6 with the chained operation being rewind for all devices, plus in the SET DIAGNOSE CCW the BLK INT is activated as well as the force DVE BSY bit.

PROGRAM STEP C41

Function: An SIO is given for each and every device connected to the CU such that a rewind is initiated.

PROGRAM STEP C42

Function: A second SIO with a SET DIAGNOSE maintaining the BLK INT and force DVE BSY sent for each and every device in accordance with steps D3–D6. A DVE BSY should be received for each and every device. If not, an error is logged. If it is received, the OLT is exited with the subsystem being reset to normal conditions by a second SET DIAGNOSE resetting the BLK INT and DVE BSY flags and breaking the chain.

Test 8 — Establishing Concurrent Scope Loops Using BLK UC FLG

The subject flag is effective only for ending status, i.e., blocks interrupts for ending status only—not for intermediate status. It enables maintenance personnel, via an OLT or utility program, to enter a failing chain of CCW's that will continuously loop in the channel independent of the CPU. That is, a channel processor has a transfer in channel (TIC) which enables a set of chained CCW's, i.e., commands, to be repeated thereby establishing a repetitive loop suitable for presenting signals on an oscilloscope. This can be done on a concurrent basis as set forth below. Repeating program loops is so well known it is not described.

Such TIC is usually broken based upon a UC interrupt and requires a second SIO to restart the commands. By suppressing the UC by setting the BLK UC FLG, the channel processor which is intermediate to the CPU and the I/O subsystem never sees the interruption condition and therefore will continuously execute the command loop at channel speeds, which are much higher than CPU channel processor I/O subsystem speeds. The I/O controller assembles ending status in a normal manner. The microprogram then proceeds to the branch operation which checks for BLK UC. Since the flag has been set by the SET DIAGNOSE CCW, normal ending status is supplied to the channel processor. The CU then returns to IDLESCAN routine awaiting the next channel processor command. With a TIC in the channel processor, the command comes almost immediately such that the command is repeated and ending status is again assembled with the process being repeated until the operator supplies a command through the operator's console to supply an SIO resetting BLK INT to the channel processor. The programs in the CPU are a utility that sets a selected command sequence that would fail with CCW BLK INT inhibiting ending status. The utility can run concurrently with data processing operations with the command being erased through the operator's console. Additionally, by manually dropping the ready condition on the device associated with the TIC loop, a UC initial status is given which is not blocked by the BLK UC FLG. This initial UC breaks the command chain and the diagnostic BLK UC stops CU from sending status at the end of a burst operation (read, write). Compare with BLK INT which inhibits sending SUPPRI.

A modification to such a utility is an automatic restart. Upon the resetting of ready by the operator, the utility could restart the device and continue on with the loop. By dropping the loop, which releases the channel processor for other operations, the concurrency reaches to the channel level, i.e., the channel can be used for diagnostic purposes during scoping; then, releasing for data processing operations by dropping ready on the addressed MTU. By raising ready, the automatic restart within the utility restarts the TIC loop for more diagnostics.

The CPU program flowcharts are encoded in MACROS, such as shown below. Such macros invoke OLTEP as described in IBM Systems Reference Library, "IBM System/360 Operating System On-Line Test Executive Program," File S360–37, Form C28–6650–2, Copyright 1967, 1968, 1969, International Business Machines Corporation for program 360S–DN–533. OLTEP in turn drives 360 BAL (Basic Assembler Language) to generate machine coding. The subject flowcharts can also be implemented on a standalone basis, i.e., not concurrently and still use the block flag concepts.

Exemplary source statements for concurrent tests generated based upon the flowcharting including test numbers 1, 2, and 3 are:

```
         DC      AL1(0+L'QRTN1)
QRTN1    DC      CL13'DEV BUSY TEST'
RTN01    DS      0H .                    ENTRY POINT TO THIS ROUTINE.

         BAL     LINK,SNSALL             GO SENSE ALL DRIVES
PRIMDEA  TM      RUNFLGS(WK1),RAN        CK IF NOT USING DEVICE
         BO      PRIMDEN
         ZEXPE CCW=(CCWSTAK,2),EXDES='BLOCK INTRPTS',
               CSW1CT=1,
               SNSLTH=NO,
               TIME=1,
               INTCT=1,TIMEOUT=YES,CSW1STA=08,SNSOFF=NO,
               REFNUM=1

***************************
***** EXIO INITIATION *****
***************************
         BAL     LINK1,QEXIO3 .          GO EXIO,WAIT,CHECK,PRINT ERRORS.
         DC      B'00001111' .           FLAG BYTE.
         DC      B'00000000' .           2ND FLAG BYTE.
         DC      AL1(2) .              COUNT OF CCWS IN CHAIN.
QEXW0006 DC      AL4(CCWSTAK) .             ADDRESS OF CCW CHAIN.
         DC      AL1(L'QEXD0006)
QEXD0006 DC      CL13'BLOCK INTRPTS'
QEXT0006 DC      AL2(1) .            'WAIT' TIME.
*                                        EXPECT CC OF 0 (AVAILABLE).
*                                        EXPECT ONE INTERRUPT.
         DC      B'10000010' .           1ST I/O CHECK FLAG BYTE.
         DC      B'01010000' .           2ND I/O CHECK FLAG BYTE.
         DC      B'00010000' .           3RD I/O CHECK FLAG BYTE.
QCKI0007 DC      X'08' .              CSW1 STATUS MASK.
QCKC0007 DC      AL1(1)                      CSW1 COUNT MASK.

         DC      AL1(128+0) .             NUMBER OF MSG LINES
Q0008RF  DC      AL1(1) .             REFERENCE NUMBER IN BINARY



         DS      0H

         TM      QDRIVER,X'FF'           CK IF OLTSEP DRIVER
         BZ      PRIMOS                  BR IF NOT
         TM      QDRIVER,X'80'
         BO      PRIMOS                  BR IF NOT
         ZEXPF CCW=(CCWFREE,2),EXDES='CK DEV BUSY',
               CC=1,INTCT=0,INITSTA=14,SNSLTH=NO,SNSOFF=NO,
               TIME=1,
               REFNUM=2

***************************
***** EXIO INITIATION *****
***************************
         BAL     LINK1,QEXIO3 .          GO EXIO,WAIT,CHECK,PRINT ERRORS.
         DC      B'00001111' .           FLAG BYTE.
         DC      B'00000000' .           2ND FLAG BYTE.
         DC      AL1(2) .              COUNT OF CCWS IN CHAIN.
QEXW0010 DC      AL4(CCWFREE) .             ADDRESS OF CCW CHAIN.
         DC      AL1(L'QEXD0010)
QEXD0010 DC      CL11'CK DEV BUSY'
QEXT0010 DC      AL2(1) .            'WAIT' TIME.
```

```
* .                                            EXPECT CC OF 1 (STATUS STORED).
*                                              EXPECT NO INTERRUPTS.
         DC       B'00011000' .                1ST I/O CHECK FLAG BYTE.
         DC       B'00000000' .                2ND I/O CHECK FLAG BYTE.
QCKI0011 DC       X'14' .                   INITIAL STATUS MASK.

         DC       AL1(128+0) .                  NUMBER OF MSG LINES
Q0012RF  DC       AL1(2) .                  REFERENCE NUMBER IN BINARY
         DS       0H

PRIMOS   ZEXPE CCW=(CCWFREE,2),EXDES='CK NOT BUSY',
                  CSW1ADR=16,SNSON=QN3,SNSOFF=QF3,
                  TIME=2,VARYCDS=QCDSADR,
                  REFNUM=3

****************************
***** EXIO INITIATION *****
****************************
PRIMOS   BAL      LINK1,QEXIO3 .               GO EXIO,WAIT,CHECK,PRINT ERRORS
         DC       B'01111111' .                FLAG BYTE.
         DC       B'00000000' .                2ND FLAG BYTE.
         DC       AL1(2) .                   COUNT OF CCWS IN CHAIN.
QEXWPRIM DC       AL4(CCWFREE) .                  ADDRESS OF CCW CHAIN.
QEXVPRIM DC       AL2(QCDSADR-SECTIO) OFFSET TO ADDRESS OF EXIO'S CDS
         DC       AL1(L'QEXDPRIM)
QEXDPRIM DC       CL11'CK NOT BUSY'
QEXTPRIM DC       AL2(2) .             'WAIT' TIME.
* .                                            EXPECT CC OF 0 (AVAILABLE).
*                                              EXPECT ONE INTERRUPT.
*                                              EXPECT CSW1 STATUS TO = '0C00'.
*                                              EXPECT CSW1 COUNT TO = 0.
         DC       B'10000011' .                1ST I/O CHECK FLAG BYTE.
         DC       B'11110011' .                2ND I/O CHECK FLAG BYTE.


         DC       B'01000000' .                3RD I/O CHECK FLAG BYTE.
QCKAPRIM DC       AL1((16)/8) 8-BYTE OFFSET TO CHAIN END.
QCKNPRIM DC       AL1(QN3) .                   'ON' SENSE MASK NUMBER.
QCKFPRIM DC       AL1(QF3) .                   'OFF' SENSE MASK NUMBER.

         DC       AL1(128+0) .                  NUMBER OF MSG LINES
PRIMOSRF DC       AL1(3) .                  REFERENCE NUMBER IN BINARY
         DS       0H
PRIMDEN  ZNCDS
PRIMDEN  BAL      LINK1,QNCDS STEP CDS POINTER
*                                              SET TO NEXT DEVICE
         BNZ      PRIMDEA                      BR IF ANOTHER DEVICE
         ZRTND *
         B        QSUEND .                      BRANCH TO END THIS ROUTINE PASS
****************************************************************************
         ZRTNI 'STACKED STATUS TEST'

****************************************************************************
**
**                                          ROUTINE
**                                             2
**
****************************************************************************
```

```
         DC     AL1(0+L'QRTN2)
QRTN2    DC     CL19'STACKED STATUS TEST'
RTNO2    DS     OH .                        ENTRY POINT TO THIS ROUTINE.

*********************************************************************
*
*
*********************************************************************

         TM     QDRIVER,X'FF'          CK IF STANDALONE DRIVER
         BZ     NODRVR
         TM     QDRIVER,X'80'
         BZ     PRIMDEM                 BR IF YES
NODRVR   ZPRNT  HEADER=NO,
                MSG='AE0264 OLTSEP DRIVER REQD, PGM ABORT'
NODRVR   BAL    LINK1,QPRMG .       PRINT THE MESSAGE
NODRVRFG DC     AL1(0+1) .            NUMBER OF MSG LINES
NODRVRRF DC     AL1(100) .              REFERENCE NUMBER IN BINARY
         DC     AL1(128+(36)) .     BYTE COUNT & IN-LINE FLAG
NODRVR1  DC     CL36'AE0264 OLTSEP DRIVER REQD, PGM ABORT'
         DS     OH
         B      QSUEND

         XC     QSNM4+19(2),QSNM4+19 CLEAR PRIMED SENSE MASK
         OI     QSFM4+19,X'FF'
         OI     QSFM4+20,X'FF'

PRIMDEM  BAL    LINK,SNSALL            GO SENSE ALL DRIVES
         MVI    QTECSD01+6,0
         BAL    LINK,MATCHCU           GO MATCH TCU ADDRESSES
PRIMDE0A ST     WK7,DRIVECT            SAVE THE DRIVE COUNT

PRIMDE0  TM     RUNFLGS(WK1),GOT       CK IF RUNNING DEV
         BO     PRIMDE01               YES, BR
         ZNCDS
         BAL    LINK1,QNCDS STEP CDS POINTER
*                                      SET TO NEXT DEVICE
         B      PRIMDE0                CK NEXT DEVICE

PRIMDE01 LR     WK6,WK1                ACTIVE DRIVE POINTER
         L      WK3,0(WK1)
         ST     WK1,FIRSTDR            SAVE THE CDS ADDRESS OF FIRST
         B      PRIMDE22
PRIMDE2  L      WK3,0(WK1)             UNIT ADRS
PRIMDE22 SLL    WK3,28                 CLEAR ALL BUT DRIVE ADRS
         SRL    WK3,28
         LA     WK4,8
         CR     WK3,WK4                IN BYTE 19 OR BYTE 20
         BL     PRIMDE3                BR IF IN BYTE 19

         SR     WK3,WK4
         LA     WK4,20                 BYTE TO CHECK
         B      PRIMDE4

PRIMDE3  LA     WK4,19                 BYTE TO CK
PRIMDE4  LA     WK5,1                  ESTABLISH THE ON SNS MASK BITS
         SLL    WK5,0(WK3)
         IC     WK6,QSNM4(WK4)         FETCH OLD MASK
         OR     WK5,WK6             OR IN THE NEW BITS
         STC    WK5,QSNM4(WK4)      SAVE IT

         ZEXIO CCW=(CCWSTAK,2),EXDES='BLOCK INTRPTS',
               SNSLTH=NO

****************************
***** EXIO INITIATION *****
****************************
         BAL    LINK1,QEXIO1 .      GO ISSUE EXIO.
         DC     B'00001110' .       FLAG BYTE.
         DC     B'00000000' .       2ND FLAG BYTE.
         DC     AL1(2) .          COUNT OF CCWS IN CHAIN.
QEXW0022 DC     AL4(CCWSTAK) .        ADDRESS OF CCW CHAIN.
         DC     AL1(L'QEXD0022)
QEXD0022 DC     CL13'BLOCK INTRPTS'
         DS     0H
         ZWAIT TIME=1
         BAL    LINK1,QDELAY .      GO DELAY FOR
QDLY0023 DC     AL2(1)            THIS NUMBER OF SECONDS.

PRIMDE6  ZNCDS
PRIMDE6  BAL    LINK1,QNCDS STEP CDS POINTER
*                                   SET TO NEXT DEVICE

         TM     RUNFLGS(WK1),GOT    CK IF RUNNING DEVICE
         BZ     PRIMDE6             NO,BR

         ZEXCK CCW=(CCWSNSB,2),EXDES='SNS FOR DE PRIMED',
               TIME=1,
               CSW1ADR=16,CSW1CT=0,SNSON=QN4,
               CSW1STA=0C

****************************
***** EXIO INITIATION *****
****************************
         BAL    LINK1,QEXIO2 .      GO EXIO, WAIT, AND CHECK RESULTS
         DC     B'00111111' .       FLAG BYTE.
         DC     B'00000000' .       2ND FLAG BYTE.
         DC     AL1(2) .          COUNT OF CCWS IN CHAIN.
QEXW0026 DC     AL4(CCWSNSB) .        ADDRESS OF CCW CHAIN.
         DC     AL1(L'QEXD0026)
QEXD0026 DC     CL17'SNS FOR DE PRIMED'
QEXT0026 DC     AL2(1) .          'WAIT' TIME.
* .                                 EXPECT CC OF 0 (AVAILABLE).
*                                   EXPECT ONE INTERRUPT.
*                                   EXPECT CSW1 STATUS TO = '0C00'.



*                                   EXPECT CSW1 COUNT TO = 0.
*                                   EXPECT NO SENSE ERROR BITS.
         DC     B'01000011' .       1ST I/O CHECK FLAG BYTE.
         DC     B'11110001' .       2ND I/O CHECK FLAG BYTE.
QCKA0027 DC     AL1((16)/8) 8-BYTE OFFSET TO CHAIN END.
QCKN0027 DC     AL1(QN4) .          'ON' SENSE MASK NUMBER.
         DS     0H
         ZPROF REFNUM=1
         BAL   LINK1,QPRERR .         PRINT THE ERROR MESSAGE
         DC    AL1(128+0) .             NUMBER OF MSG LINES
Q0028RF  DC    AL1(1) .             REFERENCE NUMBER IN BINARY
         DS    0H
         BCT   WK7,PRIMDE2              BR IF ANOTHER DRIVE AVAILABLE


         ZEXPE CCW=(CCWREW,1),EXDES='CLEAR DEV ENDS',SNSLTH=NO,
               CC=1,INITSTA=08,CSW1STA=04,
               REFNUM=2,VARYCDS=QCDSADR

***************************
***** EXIO INITIATION *****
***************************
         BAL   LINK1,QEXIO3 .          GO EXIO,WAIT,CHECK,PRINT ERRORS.
         DC    B'01001110' .           FLAG BYTE.
         DC    B'00000000' .           2ND FLAG BYTE.
         DC    AL1(1) .             COUNT OF CCWS IN CHAIN.
QEXW0030 DC    AL4(CCWREW) .           ADDRESS OF CCW CHAIN.
QEXV0030 DC    AL2(QCDSADR-SECTID) OFFSET TO ADDRESS OF EXIO'S CDS.
         DC    AL1(L'QEXD0030)
QEXD0030 DC    CL14'CLEAR DEV ENDS'
* .                                    EXPECT CC OF 1 (STATUS STORED).
*                                      EXPECT ONE INTERRUPT.
*                                      EXPECT CSW1 STATUS TO = '0400'.
*                                      EXPECT CSW1 COUNT TO = 0.
*                                      EXPECT NO SENSE ERROR BITS.
         DC    B'11011010' .           1ST I/O CHECK FLAG BYTE.
         DC    B'11110000' .           2ND I/O CHECK FLAG BYTE.
         DC    B'01000000' .           3RD I/O CHECK FLAG BYTE.
QCKI0031 DC    X'08' .              INITIAL STATUS MASK.

         DC    AL1(128+0) .             NUMBER OF MSG LINES
Q0032RF  DC    AL1(2) .             REFERENCE NUMBER IN BINARY
         DS    0H
         L     WK7,DRIVECT              FETCH THE DRIVE COUNT AGAIN
         L     WK1,FIRSTDR              FETCH FIRST CDS ADDRESS
         ST    WK1,QCDSADR
         B     PRIMDN4

         ZNCDS FIRST=YES
         BAL   LINK1,QNCDS2 RESET CDS POINTER
*                                       RESET TO FIRST DEVICE

PRIMDNO  TM    RUNFLGS(WK1),GOT         CK IF RUNNING DRIVE
         BO    PRIMDN4                  BR IF YES
PRIMDE70 ZNCDS
PRIMDE70 BAL   LINK1,QNCDS STEP CDS POINTER
*                                       SET TO NEXT DEVICE
         B     PRIMDNO

PRIMDN4  ST    WK1,QWIOCDS              SET TO WAIT FOR DE INTRPT
         ZWAIT WAIT=YES,TIME=1
         BAL   LINK1,QWAIT2 .           GO WAIT.
         DC    B'00100000'
         DC    AL2(1) .             MAXIMUM WAIT TIME IN SECONDS.
         DS    OH
         XC    QPRCTLO(5),QPRCTLO
         ZGOCK CSW1STA=04,CSW1CT=0,INTCT=1,SELCDS=QCDSADR
         BAL   LINK1,QIOCK .         GO CHECK RESULTS OF THE EXIO.
* .                                  EXPECT CC OF 0 (AVAILABLE).
*                                    EXPECT ONE INTERRUPT.
*                                    EXPECT CSW1 COUNT TO = 0.
*                                    EXPECT NO SENSE ERROR BITS.
         DC    B'11000010' .         1ST I/O CHECK FLAG BYTE.
         DC    B'01110000' .         2ND I/O CHECK FLAG BYTE.
         DC    B'01000000' .         3RD I/O CHECK FLAG BYTE.
QCKD0037 DC    AL2(QCDSADR-SECTID) .    OFFSET TO SELECT CDS ADDRESS
QCKI0037 DC    X'04' .          CSW1 STATUS MASK.
         DS    OH

         ZPROE REFNUM=3
         BAL   LINK1,QPRERR .       PRINT THE ERROR MESSAGE
         DC    AL1(128+0) .           NUMBER OF MSG LINES
Q0038RF  DC    AL1(3) .         REFERENCE NUMBER IN BINARY
         DS    OH
         BCT'  WK7,PRIMDE70          RETURN FOR NEXT DRIVE

PRIMNCK  MVC   QSFM4+19(2),QSNM4+19
         ZEXPE CCW=(CCWSNS,1),EXDES='SNS FOR DE PRIMED CLEARED',
               CSW1ADR=08,CSW1CT=0,SNSOFF=QF4,
               REFNUM=4

***************************
***** EXIO INITIATION *****
***************************
         BAL   LINK1,QEXIO3 .        GO EXIO,WAIT,CHECK,PRINT ERRORS.
         DC    B'00111110' .         FLAG BYTE.
         DC    B'00000000' .         2ND FLAG BYTE.
         DC    AL1(1) .           COUNT OF CCWS IN CHAIN.
QEXW0040 DC    AL4(CCWSNS) .          ADDRESS OF CCW CHAIN.
         DC    AL1(L'QEXD0040)
QEXD0040 DC    CL25'SNS FOR DE PRIMED CLEARED'
* .                                  EXPECT CC OF 0 (AVAILABLE).
*                                    EXPECT ONE INTERRUPT.
*                                    EXPECT CSW1 STATUS TO = '0C00'.
*                                    EXPECT CSW1 COUNT TO = 0.
         DC    B'00000011' .         1ST I/O CHECK FLAG BYTE.
         DC    B'11110010' .         2ND I/O CHECK FLAG BYTE.

QCKA0041 DC    AL1((08)/8) 8-BYTE OFFSET TO CHAIN END.
QCKF0041 DC    AL1(QF4) .             'OFF' SENSE MASK NUMBER.

         DC    AL1(128+0)             NUMBER OF MSG LINES
Q0042RF  DC    AL1(4) .         REFERENCE NUMBER IN BINARY
         DS    OH


         BAL   LINK,MATCHCU          GO-FETCH NEXT CONTROL UNIT
         B     PRIMDEOA
         ZRTND **
************************************************************************
```

```
CCWDMR   CCW    PE,*,X'40',1
         CCW    SET,DMRST,X'40',4
         CCW    RDF,INPUT,X'50',80
         CCW    SNS,QTECSD01,0,24

DMRST    DC     AL1(DMR,0,0,0)
INPUT    DC     XL80'0'

CCWSTAK  CCW    SET,STAKD,X'40',4    STACK STATUS CCW
         CCW    ERG,*,0,1            ERASE GAP

CCWSTKS  CCW    SET,STAKD,X'40',4    BLOCK INTERRUPTS
         CCW   SNS,QTECSD01,0,24       SENSE

CCWFREE  CCW    ERG,*,X'40',1
         CCW    SNS,QTECSD01,0,24    SENSE

STAKD    DC     AL1(0,INT,0,0)       STACK STATUS MODIFIER
**************************************** MATCH CDS SUBROUTINE ******
*
********************************************************************

********************************************************************
*
* ALL CDS ENTRIES ARE COMPARED AGAINST THE PRIMARY CDS DEVICE ADDRESS
* THOSE WHICH HAVE MATCHING CONTROL UNIT SERIAL NUMBERS WILL HAVE
* 'RUN' FLAG SET IN BYTE 'RUNFLGS' OF THEIR CDS.  'RUN' WILL NOT BE
* SET FOR ANY MULTIPLY DEFINED DRIVES AFTER THE FIRST. UPON REENTRY
* 'RAN' WILL BE SET FOR DRIVES WHOSE CDS HAS 'RAN' OR 'RUN' FLAGS ON
* NEW DRIVES WILL THEN BE SELECTED FROM THOSE FOR WHICH 'RAN'=0.  IF
* WHEN NO MORE 'RAN'=0 DRIVES EXIST THE RTN WILL BE TERMINATED
* (ZRTND).  NOTE: IF DRIVES ARE MULTIPLY DEFINED IN CDS THE MULTIPLE
* ENTRIES WILL BE OMITTED FROM TESTING.
*
* WK7 WILL EQUAL THE NUMBER OF DRIVES ON THE CU MINUS ONE ON EXIT
*
********************************************************************

MATCHCU  ZNCDS  FIRST=YES
MATCHCU  BAL    LINK1,QNCDS2 RESET CDS POINTER
*                                    RESET TO FIRST DEVICE
         TM     QTECSD01+6,X'FF'     CK IF SNS DATA EXISTS FOR DEV

         BZ     MATCHCU0             BR IF NOT
         LH     WK3,QTECSD01+13      FETCH CU SERIAL
         SLL    WK3,18
         SRL    WK3,18
         AH     WK3,=AL2(10000)
         CVD    WK3,QWKTEMP+16       CONVERT IT TO DECIMAL
         UNPK   QWKTEMP(16),QWKTEMP+16
         OI     QWKTEMP+15,X'F0'
         MVC    MATMSG1+10(5),QWKTEMP+11
         MVI    QTECSD01+6,0         CLEAR SNS DATA
MATMSG   ZPRNT  HEADER=NO,MSG='AE0260 CU XXXXX TESTED'
MATMSG   BAL    LINK1,QPRMG .      PRINT THE MESSAGE
MATMSGFG DC     AL1(0+1) .           NUMBER OF MSG LINES
MATMSGRF DC     AL1(100) .               REFERENCE NUMBER IN BINARY
         DC     AL1(128+(22)) .    BYTE COUNT & IN-LINE FLAG
MATMSG1  DC     CL22'AE0260 CU XXXXX TESTED'
```

```
         DS    0H
MATCHCU0 TM    RUNFLGS(WK1),GOT+RAN CK RAN AND RUN FLAGS
         BZ    MATCHCU1             NONE, BR
         NI    RUNFLGS(WK1),255-GOT CLEAR RUN
         OI    RUNFLGS(WK1),RAN     SET RAN
MATCHCU1 ZNCDS
MATCHCU1 BAL   LINK1,QNCDS STEP CDS POINTER
*                                   SET TO NEXT DEVICE
         BNZ   MATCHCU0             RETURN FOR NEXT DRIVE

MATCHCU2 TM    RUNFLGS(WK1),RAN     CK IF DEVICE RAN
         BZ    MATCHCU3             NO, BR
         ZNCDS
         BAL   LINK1,QNCDS STEP CDS POINTER
*                                   SET TO NEXT DEVICE
         BNZ   MATCHCU2             RETURN FOR NEXT ENTRY
         TM    FLAGR,GONE           CK IF TEST RAN
         BO    QSUEND               YES, BR
         ZPRNT REFNUM=61,
               MSG=(' NOT ENOUGH DRIVES FOR TEST',' PGM ABORT')
         BAL   LINK1,QPRMG .      PRINT THE MESSAGE
Q0048FG  DC    AL1(128+2) .          NUMBER OF MSG LINES
Q0048RF  DC    AL1(61) .            REFERENCE NUMBER IN BINARY
         DC    AL1(128+(27)) .    BYTE COUNT & IN-LINE FLAG
Q00481   DC    CL27' NOT ENOUGH DRIVES FOR TEST'
         DC    AL1(128+(10)) .    BYTE COUNT & IN-LINE FLAG
Q00482   DC    CL10' PGM ABORT'
         DS    0H
         ZRTND
         B     QSUEND .              BRANCH TO END THIS ROUTINE PASS


MATCHCU3 LR    WK2,WK1              SAVE DEVICE CDS ADRS
         SR    WK7,WK7              INIT DRIVE CT
         OI    RUNFLGS(WK1),GOT     SET TO RUN

MATCHCU4 ZNCDS
MATCHCU4 BAL   LINK1,QNCDS STEP CDS POINTER
*                                   SET TO NEXT DEVICE

         BNZ   MATCHCU7
         LTR   WK7,WK7              CK DRIVE COUNT
         BZ    MATCHCU              BR IF ONLY DRIVE ON CU
         OI    FLAGR,GONE           SET TEST RAN FLAG
         BR    LINK                 EXIT TO RTN FOR TEST
MATCHCU7 CLC   CUSER(2,WK1),CUSER(WK2) CK IF SAME CU
         BNE   MATCHCU4             NO, BR
         MVC   QWKTEMP(2),2(WK1)
         NI    QWKTEMP+1,X'F0'
         MVC   QWKTEMP+2(2),2(WK2)
         NI    QWKTEMP+3,X'F0'
         CLC   QWKTEMP(1),QWKTEMP+2  CK CHANNEL ADDRS
         BNE   MATCHCU4             BR- IF NOT SAME
         CLC   QWKTEMP+1(1),QWKTEMP+3  CK CU ADDRS
         BNE   MATCHCU4

         OI    RUNFLGS(WK1),RAN     SET RAN
         LR    WK3,WK2
MATCHCU5 TM    RUNFLGS(WK3),GOT     CK IF SELECTED
```

```
         BZ    MATCHCU4              BR IF NOT
         CLC   TUSER(3,WK1),TUSER(WK3) CK IF SAME TU SERIAL
         BE    MATCHCU4              BR IF YES
         LA    WK7,1(WK7)            BUMP DRIVE COUNT
         OI    RUNFLGS(WK1),GOT      SET TO RUN
         B     MATCHCU4              RETURN FOR NEXT MATCHING CU SER
**********************************************************************

FLAGR    DC    XL1'0'                FLAGS
GONE     EQU   X'80'                 ROUTINE RAN FLAG

CCWERG   CCW   ERG,*,0,1             ERASE GAP

CCWSNSB  CCW   SET,STAKD,X'40',4
CCWSNS   CCW   SNS,QTECSD01,0,24

CCWREW   CCW   REW,*,0,1

DRIVECT  DC    AL4(0)                CU DRIVES-1
FIRSTDR  DC    AL4(0)                FIRST CU DRIVE CDS ADRS


************************************** CDS EQUATES *****************
CUSER    EQU   4                     CONTROL UNIT SERIAL BYTES (2)
CUFEAT   EQU   10                    CONTROL UNIT FEATURES BYTE
RUNFLGS  EQU   11                    PROGRAM CONTROL FLAGS
GOT      EQU   X'80'                   RUNNING THIS DEVICE
RAN      EQU   X'40'                   RAN THIS DEVICE
*        BYTE  12                    ZERO BYTE
TUFEAT   EQU   13                    TAPE UNIT FEATURES/MODEL BYTE
TUSER    EQU   14                    TAPE UNIT SERIAL BYTES (2)


************************************** SENSE ALL DEVICES SUBROUTINE
*
* A SENSE COMMAND IS ISSUED TO EACH DEVICE IN THE CDS TABLE AND ITS
* CU SERIAL, TU SERIAL, AND FEATURES BYTES ARE SAVED IN ITS CDS AREA
* FOR FUTURE PROGRAM REFERENCE.
**********************************************************************

SNSALL   DS    0H
         ZNCDS FIRST=YES
         BAL   LINK1,QNCDS2 RESET CDS POINTER
*                                    RESET TO FIRST DEVICE

SNSALLD  MVI   RUNFLGS(WK1),0        CLEAR THE RUN FLAGS
         LA    WK7,2
SNSALLTU ZEXCK CCW=(CCWINIT,2),EXDES='SNS-REW CMD',
               CSW1ADR=16,SNSON=QN3,SNSOFF=QF3,INTCT=2,CSW1CT=1

****************************
***** EXIO INITIATION *****
****************************
SNSALLTU BAL   LINK1,QEXIO2 .        GO EXIO, WAIT, AND CHECK RESULTS
         DC    B'00111110' .         FLAG BYTE.
         DC    B'00000000' .         2ND FLAG BYTE.
         DC    AL1(2) .            COUNT OF CCWS IN CHAIN.
QEXWSNSA DC    AL4(CCWINIT) .          ADDRESS OF CCW CHAIN.
         DC    AL1(L'QEXDSNSA)
QEXDSNSA DC    CL11'SNS-REW CMD'
```

```
*  .                               EXPECT CC OF 0 (AVAILABLE).
*                                  EXPECT TWO INTERRUPTS.
*                                  EXPECT CSW1 STATUS TO = '0800'.
*                                  EXPECT CSW2 STATUS TO = '0400'.
         DC    B'00000101' .       1ST I/O CHECK FLAG BYTE.

         DC    B'11011111' .       2ND I/O CHECK FLAG BYTE.
QCKASNSA DC    AL1((16)/8) 8-BYTE OFFSET TO CHAIN END.
QCKCSNSA DC    AL1(1) .                 CSW1 COUNT MASK.
QCKNSNSA DC    AL1(QN3) .          'ON' SENSE MASK NUMBER.
QCKFSNSA DC    AL1(QF3) .          'OFF' SENSE MASK NUMBER.
         DS    0H


         BZ    SNSALLC             BR IF NO ERROR
         BCT   WK7,SNSALLTU        RETRY ONE TIME
SNSALLC  TM    QTECSD01,X'40'      CK INT REQ BIT
         BZ    SNSNRDY             BR IF YES
         ZEMSG '*INT REQD',2
         BAL   LINK1,QZEMSG .      GO SET-UP THE MESSAGE FOR ZPROE.
         DC    AL1(9) .           BYTE COUNT
         DC    CL9'*INT REQD'
         DS    0H
SNSNRDY  TM    QTECSD01+1,X'02'    CK FILE PROT'D BIT
         BZ    SNSERMG             BR IF NOT
         ZEMSG '*DEV FP'
         BAL   LINK1,QZEMSG .      GO SET-UP THE MESSAGE FOR ZPROE.
         DC    AL1(7) .           BYTE COUNT
         DC    CL7'*DEV FP'
         DS    0H
         OI    QFLGA,QQERR
SNSERMG  ZPROE REFNUM=73,MSG=' RTN BYPASSED FOR DEV'
SNSERMG  BAL   LINK1,QPRERR .     PRINT THE ERROR MESSAGE
         DC    AL1(128+1) .         NUMBER OF MSG LINES
SNSERMRF DC    AL1(73) .         REFERENCE NUMBER IN BINARY
         DC    AL1(128+(21)) .   BYTE COUNT & IN-LINE FLAG
SNSERM1  DC    CL21' RTN BYPASSED FOR DEV'
         DS    0H
         BZ    SNSNER              BR IF NO ERROR
         OI    RUNFLGS(WK1),RAN    SET THE RAN FLAG
SNSNER   MVC   CUSER(2,WK1),QTECSD01+13 MOVE CU SERIAL BYTES
         MVC   TUSER(2,WK1),QTECSD01+15 MOVE TU SERIAL BYTES
         MVC   TUFEAT(1,WK1),QTECSD01+6 MOVE TU FEATURE BYTE
         NI    TUFEAT(WK1),X'AF'   REMOVE NON-FEATURE BITS
         MVC   CUFEAT(1,WK1),QTECSD01+17 MOVE CU FEATURE BYTE

         ZNCDS
         BAL   LINK1,QNCDS STEP CDS POINTER
*                                  SET TO NEXT DEVICE
         BNZ   SNSALLD             BR IF ANOTHER DRIVE AVAILABLE

         BR    LINK                RETURN
************************************** CLEANUP ROUTINE ************
*
*******************************************************************
```

```
CLEANIT  DS    0H
         LA    BBASE,2048             LOAD SECOND                $$  TEMP
         AR    BBASE,BBASE              BASE                     $$  TEMP
         AR    BBASE,ABASE                REG                    $$  TEMP
         OI    QFLGB,QQCLNUP          SET CLEANUP BIT
         ZNCDS FIRST=YES
         BAL   LINK1,QNCDS2 RESET CDS POINTER
*                                     RESET TO FIRST DEVICE
CLEANS   ST    WK1,QWIOCØS
         ZWAIT WAIT=YES,TIME=1
         BAL   LINK1,QWAIT2 .         GO WAIT.
         DC    B'00100000'
         DC    AL2(1) .          MAXIMUM WAIT TIME IN SECONDS.
         DS    0H
         ZEXCK CCW=(CCWREW,1),SNSLTH=NO,TIME=1,
               CC=1,INITSTA=08,CSW1STA=04

***************************
***** EXIO INITIATION *****
***************************
         BAL   LINK1,QEXIO2 .         GO EXIO, WAIT, AND CHECK RESULTS
         DC    B'00001101' .          FLAG BYTE.
         DC    B'00000000' .          2ND FLAG BYTE.
         DC    AL1(1) .             COUNT OF CCWS IN CHAIN.
QEXW0062 DC    AL4(CCWREW) .            ADDRESS OF CCW CHAIN.
QEXT0062 DC    AL2(1) .            'WAIT' TIME.
*  .                                  EXPECT CC OF 1 (STATUS STORED).
*                                     EXPECT ONE INTERRUPT.
*                                     EXPECT CSW1 STATUS TO = '0400'.
*                                     EXPECT CSW1 COUNT TO = 0.
*                                     EXPECT NO SENSE ERROR BITS.
         DC    B'01011010' .          1ST I/O CHECK FLAG BYTE.
         DC    B'11110000' .          2ND I/O CHECK FLAG BYTE.
QCKI0063 DC    X'08' .              INITIAL STATUS MASK.
         DS    0H

         ZEXPE CCW=(CCWREW,1),SNSLTH=NO,
               CC=1,INITSTA=08,CSW1STA=04,
               CSW1ADR=00,SNSON=QN3,SNSOFF=QF3,
               REFNUM=73

***************************
***** EXIO INITIATION *****
***************************
         BAL   LINK1,QEXIO3 .         GO EXIO,WAIT,CHECK,PRINT ERRORS.
         DC    B'00001100' .          FLAG BYTE.
         DC    B'00000000' .          2ND FLAG BYTE.
         DC    AL1(1) .             COUNT OF CCWS IN CHAIN.
QEXW0065 DC    AL4(CCWREW) .            ADDRESS OF CCW CHAIN.
*  .                                  EXPECT CC OF 1 (STATUS STORED).
*                                     EXPECT ONE INTERRUPT.

*                                     EXPECT CSW1 STATUS TO = '0400'.
*                                     EXPECT CSW1 COUNT TO = 0.
         DC    B'00011011' .          1ST I/O CHECK FLAG BYTE.
         DC    B'11110011' .          2ND I/O CHECK FLAG BYTE.
QCKI0066 DC    X'08' .              INITIAL STATUS MASK.
QCKA0066 DC    AL1((00)/8) 8-BYTE OFFSET TO CHAIN END.
```

```
QCKN0066 DC     AL1(QN3) .           'ON' SENSE MASK NUMBER.
QCKF0066 DC     AL1(QF3) .           'OFF' SENSE MASK NUMBER.

         DC     AL1(128+0) .           NUMBER OF MSG LINES
Q0067RF  DC     AL1(73) .           REFFERENCE NUMBER IN BINARY
         DS     0H
         ZNCDS
         BAL    LINK1,QNCDS STEP CDS POINTER
*                                   SET TO NEXT DEVICE
         BNZ    CLEANS              RETURN TO CLEANUP NEXT DEV
         B      QDTERM              TERMINATE THE SECTION


         ZSNON  ('00',
                1,'08',             QN2 - LOAD POINT
                1,'4000000040',     QN3 - TU STAT A
                '0000000000000000000000000000000000000000000000')


********************** 'ON' BIT SENSE MASKS ********************
*
***************************************************************

QN1      EQU    1 .                 ON-BIT MASK NUMBER.
QSNP1    DC     AL1(0) .           SENSE BYTE POSITION.
         DC     AL1(L'QSNM1) .      MASK LENGTH.
QSNM1    DC     X'00'
QN2      EQU    2 .                 ON-BIT MASK NUMBER.
QSNP2    DC     AL1(1) .           SENSE BYTE POSITION.
         DC     AL1(L'QSNM2) .      MASK LENGTH.
QSNM2    DC     X'08'
QN3      EQU    3 .                 ON-BIT MASK NUMBER.
QSNP3    DC     AL1(1) .           SENSE BYTE POSITION.
         DC     AL1(L'QSNM3) .      MASK LENGTH.
QSNM3    DC     X'4000000040'
QN4      EQU    4 .                 ON-BIT MASK NUMBER.
QSNP4    DC     AL1(0) .           SENSE BYTE POSITION.
         DC     AL1(L'QSNM4) .      MASK LENGTH.
QSNM4    DC     X'0000000000000000000000000000000000000000000000
QSTCN5   EQU    *
         DS     0H
         ZSNOF  ('40',              QF1
                '00',               QF2 - UNUSED
                1,'2000000080',     QF3 -
                'FFA100F9FCBE40EFDF41BDFDFD00000000000000000000')
                'FFA100FDFCBE40EFDF41BDFDFD',
                'FFA100F9FABE50EFDF41BDFDFD',
                'FFA100FDFABE40EFDF41BDFDFD',
                '7FA1',

                '00000000000000000000000000000000000000000000000')


********************** 'OFF' BIT SENSE MASKS ********************
*
***************************************************************

QF1      EQU    1 .                 OFF-BIT MASK NUMBER.
QSFP1    DC     AL1(0) .           SENSE BYTE POSITION.
```

```
         DC      AL1(L'QSFM1) .         MASK LENGTH.
QSFM1    DC      X'40'
QF2      EQU     2 .                    OFF-BIT MASK NUMBER.
QSFP2    DC      AL1(0) .              SENSE BYTE POSITION.
         DC      AL1(L'QSFM2) .         MASK LENGTH.
QSFM2    DC      X'00'
QF3      EQU     3 .                    OFF-BIT MASK NUMBER.
QSFP3    DC      AL1(1) .              SENSE BYTE POSITION.
         DC      AL1(L'QSFM3) .         MASK LENGTH.
'QSFM3   DC      X'2000000080'
QF4      EQU     4 .                    OFF-BIT MASK NUMBER.
QSFP4    DC      AL1(0) .              SENSE BYTE POSITION.
         DC      AL1(L'QSFM4) .         MASK LENGTH.
QSFM4    DC      X'FFA100F9FCBE40EFDF41BDFDFD000000000000000000000000
QSTCF5   EQU     *       0 1 2 3 4 5 6 7 8 9 A B C D E F 0 1
         DS      0H

CCWINIT  CCW     SNS,QTECSD01,X'40',24
         CCW     REW,*,0,1              REWIND
         ZTEND EVENTS=18

************************* BASIC EXIO SUBROUTINE *****************
*
*   ENTRY LINKAGE:
*
*        BAL     LINK1,QEXI01           (IF INITIATED BY ZEXIO)
*        BAL     LINK1,QEXI02 .         (IF INITIATED BY ZEXCK)
*        DC      XL1'XX'   FLAG BYTE.
*                BIT 1 = 1,OFFSET TO EXIO CDS ADDRESS IS PRESENT.
*                BITS 2-3 =00, NO SENSE IN CCW CHAIN.
*                         =01, CCW-CHAIN SENSE BYTE-COUNT PRESENT.
*                         =11, CCW-CHAIN SENSE BYTE-COUNT DEFAULT.
*                BITS 4-5 =00, NO SENSE ON UNIT-CHECK.
*                         =01, UNIT-CHECK SENSE BYTE-COUNT PRESENT.
*                         =11, UNIT-CHECK SENSE BYTE-COUNT DEFAULT.
*                BIT 6 =1, EXIO DESCRIPTION PRESENT.
*                BIT 7 =1, 'TIME' SPECIFIED IN ZEXCK OR ZEXPE.
*        DC      XL1'XX'   FLAG BYTE 2.
*                BIT 0 = 1, THIS COMMAND IS FOR A LIBRARY UNIT.
*                BIT 1 = 1, DO NOT CLEAR TECB SENSE AREA.
*                BIT 2 = 1, BYPASS OS SENSE ON UNIT-CHECK.
*                BIT 3 = 1, DO NOT CLEAR TECB (MASK LABEL=QFXNTCLR).
*        DC      AL1(X)    COUNT OF CCWS IN CCW-CHAIN.
*        DC      AL4(ADDR) ADDRESS OF CCW-CHAIN (CAW).
*       *DC      AL2(X)    BYTE-COUNT OF SENSE IN CCW CHAIN.
*       *DC      AL2(X)    BYTE-COUNT OF SENSE IF UNIT-CHECK OCCURS.
*       *DS      AL2(X)    OFFSET TO EXIO CDS ADDRESS.
*       *DC      AL1(X)       BYTE COUNT OF FOLLOWING DC, IF PRESENT.
*       *DC      C'DESCRIP'   EXIO DESCRIPTION IN EBCDIC IF FLAG BIT 6=1
*       *DC      AL2(X)    'WAIT' TIME SPECIFIED IN ZEXCK OR ZEXPE.
*
*               *THE ASTERISKED DC STATEMENTS WILL NOT BE PRESENT IF
*                INDICATED FLAG BITS ARE NOT ONE.
*
*****************************************************************
QEXI01   DS      0H .                   ZEXIO ENTRY POINT.
         NI      QFLGB,255-QQXCK-QQXPE
         B       QEXI00
QEXI02   DS      0H .                   ZEXCK ENTRY POINT.
```

```
         OI     QFLGB,QQXCK
         B      QEXIOO
QEXIO3   DS     OH .                 ZEXPE ENTRY POINT.
         OI     QFLGB,QQXPE
         NI     QFLGB,255-QQXCK

QEXIOO   DS     OH

         STM    WKO,LINK,QOLTREGS . SAVE OLT'S REGS.
         MVC    QEXFLAG(2),O(LINK1) SAVE FLAG BYTE.
         LA     LINK1,2(LINK1) .    STEP OVER THE FLAG BYTES.

*                                   STORE EXIO PARAMETERS PROVIDED.
         MVC    QXIOCCWC(1),O(LINK1) STORE CCW COUNT IN EXIO LIST.
         MVC    QXIOCCWA(4),1(LINK1) STORE CCW ADDRESS IN EXIO LIST.
         LA     LINK1,5(LINK1) .    STEP OVER THE CCW COUNT & ADDRESS.

         MVC    QCHSNS,O(LINK1) .   SET-UP CHAIN'S SENSE-LENGTH.
         LA     WK2,24
         LA     LINK1,2(LINK1)
         TM     QEXFLAG,QEXFCHSN
         BM     QEXSNCH
         BO     QEXSNCHD
         SR     WK2,WK2
QEXSNCHD STH    WK2,QCHSNS
         SH     LINK1,=AL2(2)
QEXSNCH  DS     OH

         TM     QEXFLAG+1,QEXNTCLR .IF TECB NOT TO BE CLEARED,
         BO     QEXSKPCL             BRANCH.
         XC     QTECSNOC(QTECBEND-QTECSNOC),QTECSNOC CLEAR TECB FIELDS
QEXSKPCL DS     OH

         MVC    QUCSNS,O(LINK1) .   SET-UP UNIT-CHECK SENSE-LENGTH.
         LA     WK2,24 .
         LA     LINK1,2(LINK1)
         TM     QEXFLAG,QEXFUCSN
         BM     QEXSNUC
         BO     QEXSNUCD
         SR     WK2,WK2
QEXSNUCD SH     LINK1,=AL2(2)
         STH    WK2,QUCSNS
QEXSNUC  DS     OH
QEXNOTSU EQU    *
         L      WK3,QCDSADR .        GET CURRENT DRIV'S CDS ADDRESS.
         TM     QEXFLAG,QVARY .      IF CDS VARY NOT REQUESTED,
         BZ     QNOVARY .            BRANCH.
         MVC    QWKTEMP(2),O(LINK1)
         LA     LINK1,2(LINK1)
         LR     WK3,ABASE .
         AH     WK3,QWKTEMP
         L      WK3,O(WK3) .         GET 'VARIED' CDS ADDRESS.
         MVC    QCUU(4),CDSUNIT(WK3) STORE CUU FOR ZEXPE OR ZEXCK.
QNOVARY  DS     OH
         ST     WK3,QXIOCDSA
         ST     WK3,QWIOCDS .        STORE CDS ADDRESS IN WAIT MACRO TOO.
         SR    WK2,WK2
         TM    QEXFLAG,QEXFDESC .  IF AN EXIO DESCRIPTION (EXDES=).IS
         BZ    QEXNDESN .          PRESENT, STORE IT FOR ERROR
         IC    WK2,0(LINK1) .      PRINTING.
         LA    LINK1,1(LINK1)

         MVC   QDISEXIB(L'QDISEXIB),0(LINK1)
         AR    LINK1,WK2
QEXNDESN DS    0H
         LA    WK2,QDISREFL+L'QDISBFRB(WK2)
         STC   WK2,QDISEXIL

         ST    LINK1,QEXTEMP1
         BAL   LINK1,QEXCEXIO .    GO EXECUTE THE EXIO.
         L     LINK1,QEXTEMP1 .    GET LINKAGE ADDRESS.
         TM    QFLGB,QQXCK+QQXPE . IF WAIT AND CHECK AREN'T TO BE
         BZ    QRESREGS .          INCLUDED IN EXIO SUBROUTINE,RETURN

*  PROCEED WITH THE WAIT AND THE I/O CHECK.
QEXWAIT  DS    0H
         MVC   QWIOTIME(2),QTMEDFLT STORE DEFAULT TIME.
         MVI   QWIOFLAG,X'80' .    SET FOR WAIT=YES.
         TM    QEXFLAG,QEXFTIME .  IF NO TIME PARAMETER PRESENT,
         BZ    QEXNTMEP .          BRANCH.
         MVC   QWIOTIME(2),0(LINK1) STORE 'TIME' PROVIDED.
         LA    LINK1,2(LINK1)
QEXNTMEP DS    0H

         ST    LINK1,QEXTEMP1
         BAL   LINK1,QWAIT .       GO WAIT.
         L     LINK1,QEXTEMP1
         B     QIOCKO .            GO CHECK RESULTS.

         B     QRESREGS .          GO RESTORE REGS AND RETURN.

*  QEXIO1 STORAGE,CONSTANTS,FLAGS.
         DS    0F
QEXTEMP1 DC    XL4'00' .           TEMPORARY STORAGE.
QCHSNS   DC    AL2(24) .         STORAGE. SENSE-LENGTH IN CHAIN.
QUCSNS   DC    AL2(24) .      STORAGE. SNS-LTH IF UNIT-CHECK.

QEXFLAG  DC    XL2'00' LINKAGE FLAG BYTES.
QVARY    EQU   X'40' .                   -CDS ADDR OFFSET PRESENT.
QEXFCHSN EQU   X'30' .                   -CHAIN SENSE-LENGTH FLAGS.
QEXFUCSN EQU   X'0C' .                   -UNIT-CHK SENSE-LENGTH FLAGS
QEXFDESC EQU   X'02' .                   -EXIO DESCRIPTION PRESENT.
QEXFTIME EQU   X'01' .                   -'TIME' PRESENT.

QEXLIB   EQU   X'80' .     BYTE 2 FLAGS -LIBRARY UNIT COMMAND.
QEXNOCLR EQU   X'40' .                  -DO NOT CLEAR TECB SENSE AREA
QEXSNSNO EQU   X'20' .                   -BYPASS OS UNIT-CHK SENSE
QEXNTCLR EQU   X'10' .                   -DON'T CLEAR TECB.


*************************** WAIT SUBROUTINE **********************
*
```

```
*  LINKAGE WITH NO PARAMETERS:
*
*        BAL   LINK1,QWAIT1
*
*                   DEFAULTS TO:
*                               'CDSADR=CDS ADDR FROM LAST EXIO'
*                               'WAIT=YES'
*                               'TIME=99'
*
*  LINKAGE WITH PARAMETERS:
*
*        BAL   LINK1,QWAIT2
*        DC    XL1'00'        FLAG BYTE.
*              BIT 0 = 1, WAIT=ANY.
*              BIT 1 = 1, WAIT=DE.
*              BIT 2 = 1, TIME= PARAMETER FURNISHED.
*              BIT 3 = 1, POLL=YES PARAMETER FURNISHED.
*              BIT 4 = 1, PURGE=YES.
*       *DC    AL2(INTEGER)   MAXIMUM WAIT TIME IN SECONDS.
*        DS    0H
*
*             *ASTERISKED DC'S PRESENT ONLY IF CORRESPONDING FLAG BIT
*              IS EQUAL TO ONE.
*
******************************************************************
QWAIT1   DS    0H .                ZWAIT WITH NO PARAMETERS ENTRY.
         STM   WK0,LINK,QOLTREGS . SAVE TEST'S REGS.
         MVI   QWAFLAGS,X'00' .    ZERO FLAG BYTE
         B     QWACMN

QWAIT2   DS    0H
         STM   WK0,LINK,QOLTREGS . SAVE TEST'S REGS.
         MVC   QWAFLAGS(1),0(LINK1) SAVE FLAG BYTE PARAMETER.
QWACMN   DS    0H


         MVC   QWIOCDS(4),QCDSADR .STORE WAITIO DEFAULT PARAMETERS
         MVI   QWIOFLAG,X'80'
         MVC   QWIOTIME(2),=AL2(99) .

         TM    QWAFLAGS,X'FF'
         BZ    QWANTIME
         LA    LINK1,1(LINK1) .    STORE PROVIDED PARAMETERS IN THE
         TM    QWAFLAGS,QWAFTIME . THE WAITIO MACRO.
         BZ    QWANOTME
         MVC   QWIOTIME(2),0(LINK1) STORE TIME.
         LA    LINK1,2(LINK1)
QWANOTME DS    0H
QWANTIME DS    0H

         ST    LINK1,QEXTEMP1 .    GO WAIT
         BAL   RLINK1,QWAIT
         L     LINK1,QEXTEMP1 .    GET LINKAGE ADDRESS.
         TM    QFLGB,QQXCK+QQXPE . IF IO CHECK NOT TO BE INCLUDED
         BZ    QRESREGS .          GO RETURN.

         B     QIOCK0 .            GO CHECK RESULTS.

*  QWAIT 1 & 2 SUBROUTINES' CONSTANTS AND STORAGE.
```

```
QWAFLAGS DC     XL1'00' .              PARAMETER'S FLAG BYTE.
QWAFANY  EQU    X'80' .                IF 1,WAIT=ANY.
QWAFDE   EQU    X'40' .                IF 1,WAIT=DE.
QWAFTIME EQU    X'20' .                IF 1, TIME PARAMETER PRESENT.
QWAFPOLL EQU    X'10' .                IF 1, POLLING TO TAKE PLACE.
QWAFPRGE EQU    X'08' .                IF 1,PURGE=YES.

************************ I/O CHECK SUBROUTINE *********************
*
*  LINKAGE:
*
*         BAL   LINK1,QIOCK
*         DC    XL2'00'                FLAG BYTES (SEE EQU'S AT END OF
*                                                 ROUTINE).
*        *DC    XL1'00'                3RD FLAG BYTE.
*        *DC    AL2                    OFFSET TO ADDRESS OF SELECTIVE CDS
*                                      (NEVER PRESENT WITH ZEXPE OR ZEXCK)
*        *DC    XL1 OR XL2             INITIAL STATUS MASK.
*        *DC    AL1                    OFFSET FROM START OF CCW CHAIN TO
*                                      XPTD ENDING ADDR IN DOUBLE-WORD
*                                      COUNT.
*        *DC    XL1 OR XL2             CSW1 STATUS MASK.
*        *DC    AL1 OR AL2             CSW1 COUNT MASK.
*        *DC    XL1 OR XL2             CSW2 STATUS MASK.
*        *DC    AL2                    OFFSET TO CONTINGENT CONNECT RTN.
*        *DC    AL1                    # OF SENSE-MASK OF XPTD 'ON' BITS
*        *DC    AL1                    # OF SENSE-MASK OF XPTD 'OFF' BITS
*
*               *ASTERISKED DC'S WILL NOT BE PRESENT UNLESS INDICATED BY
*                THE BITS IN THE FLAG BYTES.
*
*******************************************************************
*  SUBROUTINE'S REGISTER USAGE:
*        WK0,WK1,WK2,WK3,WK4-WORK REGS.
*        WK5  -TECB EVENT FIELD POINTER.
*******************************************************************

QIOCK    DS     0H .                   ZIOCK (ZGOCK) ENTRY POINT.
         STM    WK0,LINK,QOLTREGS .    SAVE OLT'S REGS.
QIOCK0   DS     0H .                   ZEXCK, ZEXPE ENTRY POINT.

*  PRELIMINARY HOUSEKEEPING.
         MVI    QMRCC,C' ' .           BLANK 'RCVD' MESSAGES' COLUMN 1.
         MVI    QMRIS,C' '
         MVI    QMRC1,C' '
         MVI    QMRC2,C' '

         MVC    QMXISX(4),QMXISX-1 .BLANK 'XPTD' MESSAGES' DATA AREAS
         MVC    QMXC1X(16),QMXC1X-1 .
         MVC    QMXC2X(4),QMXC2X-1 .

         MVI    QPRMSGCT,X'00' .       ZERO MESSAGE-COUNT ACCUMULATOR.
         SR     WK2,WK2
         STH    WK2,QFLGA .            CLEAR ERROR FLAG BYTES.
         STC    WK2,QPRFCCWS .         ZERO FAILING CCW NUMBER.
         XC     QMACUM,QMACUM .        CLEAR CSW ADDR,STATUS,COUNT ACCUMS
         XC     QCKCLADR(QCKCLBYT),QCKCLADR CLEAR DPRINT PRINT FLAGS.
         XC     QEXPCLRS(QEXPCLR),QEXPCLRS .  CLEAR 'EXPECTED' STORAGE
         MVC   QMFLGA(3),0(LINK1) .STORE PARAMETER'S FLAG BYTES.
         LA    LINK1,2(LINK1)
         TM    QMFLGA,QMFA .        IF ONLY TWO FLAG BYTES,

         BZ    QTWOBF BRANCH.
         LA    LINK1,1(LINK1)
         B     QTHREEBF
QTWOBF   DS    0H
         MVI   QMFLGA+2,X'00' .     ZERO 3RD BYTE.
QTHREEBF DS    0H
         TM    QMFLGC,QMR .         IF NO SELECTIVE CDS ADDR OFFSET
         BZ    QSKPCDSP .           PRESENT, SKIP PROCESSING OF ONE.
         TM    QFLGB,QQXCK+QQXPE . IF ZEXCK OR ZEXPE BEING OPERATED,
         BNZ   QSKPCDSP .           SKIP CUU STORE. (ZEXIO STORED IT.)
         MVC   QWKTEMP(2),0(LINK1)
         LA    WK1,SFCTID
         AH    WK1,QWKTEMP .        CALCULATE THE SELECTIVE CDS ADDRESS
         L     WK1,0(WK1) .         GET 'SELECTED' CDS ADDRESS.
         MVC   QCUU(4),CDSUNIT(WK1) FIND AND STORE THE DEVICE ADDRESS.
         LA    LINK1,2(LINK1)
QSKPCDSP DS    0H

         DS    0H
         LA    WK5,QTECFD01-QTECFLTH GO SET POINTER TO RECB CONDITION
         BAL   WK3,QZTFNEXT .       CODE FIELD & CONVERT FIELD TO EBCDI
         BNE   QMCCNRML .           IF NO DATA FOR SELECTED DEVICE, GO.
         CLI   0(WK5),X'FF'
         BNE   QMCCRCVD .           IF OLT(S)EP DID NOT RETURN THE CC
         LA    WK1,QTECELST-QTECFLTH ASSUME IT WAS 0,
         LA    WK2,QTECELST .       AND MANIPULATE THE TECB ACCORDINGLY
QZTFLDNX MVC   0(QTECFLTH,WK2),0(WK1)
         SH    WK2,=AL2(QTECFLTH)
         SH    WK1,=AL2(QTECFLTH)
         CLR   WK2,WK5
         BH    QZTFLDNX
         MVI   0(WK5),C'0'
         SR    WK2,WK2
         IC    WK2,QTECEVOC INCREMENT COUNT OF EVENT FIELDS USED
         LA    WK2,1(WK2)
         STC   WK2,QTECEVOC
QMCCRCVD DS    0H .
         SR    WK2,WK2 .            SET CC TO EQUAL.
QMCCNRML DS    0H
         MVI   QMRCCR,C'?' .        IF NO TECB ENTRIES RETURNED BY
         BNE   QMCCFBAD OLT(S)EP, LEAVE ? STORED.
         MVC   QMRCCR(1),0(WK5) .   STORE RCVD CONDITION-CODE.
QMCCFBAD DS    0H
         MVI   QMXCCX,X'F0' .       STORE XPTD CONDITION-CODE.
         TM    QMFLGA,QMFCDE
         BZ    QMCCSTRD .           XPTD CC=0.
         MVI   QMXCCX,X'F1'
         TM    QMFLGA,QMFE
         BO    QMCC1EXR .           XPTD CC=1.
         MVI   QMXCCX,X'F2'
         TM    QMFLGA,QMFD
         BO    QMCCSTRD .           XPTD CC=2.
         MVI   QMXCCX,X'F3'
                                    XPTD CC=3.
         B     QMCCSTRD
```

```
QMCC1EXP DS    0H
         IC    WK0,QMFLGA
         SRL   WK0,4 .             SINCE CC=1 IS EXPECTED,
         BAL   WK2,QMSUPL1B .      GO GET AND SAVE ANY INITIAL STATUS
         MVC   QEXPISTA,QMSUPSAV . MASK PRESENT.
         TM    QMFLGA,QMFC+QMFD IF NO INITIAL STATUS DEFAULT MASK,
         BC    12,QMCCSTRD .       BRANCH. (00,01,10)
         MVC   QEXPISTA,=XL2'0800' STORE DEFAULT INITIAL STATUS MASK
QMCCSTRD DS    0H

         CLC   QMRCCR(1),QMXCCX .  IF XPTD CC EQUALS RCVD CC,
         BE    QMCCOK .            BRANCH.
         OI    QFLGA,QQERR+QQCCER
         BAL   LINK,QMSERM .       SET-UP CC XPTD MESSAGE PARAMETERS
         DC    AL2(QMXCC-SECTID)
         MVI   QMRCC,C'*' .        FLAG CC RCVD AS AN ERROR LINE.
         BAL   LINK,QMSERM .       SET-UP CC RCVD MESSAGE PARAMETERS
         DC    AL2(QMRCC-SECTID)
QMCC1NEX DS    0H

         CLI   QMRCCR,X'F1' .      IF RECEIVED CC IS NOT 1,
         BNE   QMNOTCC1 .          BRANCH.
QMRCVDIS DS    0H
         MVC   QMRISR(4),QWKTEMP+16 STORE RCVD INITIAL STATUS AND
         BAL   LINK,QMSERM
         DC    AL2(QMRIS-SECTID) . SET-UP RCVD INIT STATUS MESSAGE
         OC    QMSTATUS(2),8(WK5) .ACCUMULATE STATUS BITS.
QMNOTCC1 DS    0H
         DS    0H
         BAL   WK3,QZTENEXT .      GO STEP TO NEXT TECB EVENT FIELD
*                                  AND CONVERT IT TO EBCDIC.
         BE    QMCSWSRC .          IF NO CSWS WERE RECEIVED,
         IC    WK0,QMFLGA .        STEP LINK1 AROUND MASKS IF THEY ARE
         N     WK0,=AL4(1) .       PRESENT.
         AR    LINK1,WK0 .         1.CSW1 ADDRESS MASK.
         IC    WK0,QMFLGB
         SRL   WK0,6
         BAL   WK2,QMSUPL1B .      2.CSW1 STATUS MASK.
         IC    WK0,QMFLGB
         SRL   WK0,4
         BAL   WK2,QMSUPL1B .      3.CSW1 COUNT MASK.
         IC    WK0,QMFLGB
         SRL   WK0,2
         BAL   WK2,QMSUPL1B .      4.CSW2 STATUS MASK.
         B     QMCKFRSN

QMCSWSRC DS    0H

         LA    WK2,QWKTEMP+8 .     GET ADDR OF RCVD (EBCDIC) CSW1.
         LA    WK3,QMRC1R .        GET ADDR OF RCVD CSW1 MESSAGE AREA
         BAL   LINK,QMSTRCSW GO STORE RCVD EBCDIC CSW1.
         OC    QMACUM+1(7),5(WK5) .ACCUMULATE CSW1 ADDR,STAT,COUNT

         TM    QMFLGA,QMFH .       IF ADDRESS PART OF RCVD CSW1 NOT TO
         BZ    QMC1ADNO .          BE CHECKED, BRANCH.

         SR    WK2,WK2
         IC    WK2,0(LINK1) .      GET '8-BYTE' OFFSET AND CONVERT IT
         SLL   WK2,3
```

```
          SR    WK3,WK3
          LTR   WK2,WK2 .           IF OFFSET IS ZERO,
          BZ    QADR00 .            GO CHECK FOR AN ADDRESS OF ZERO.
          L     WK3,QXIOCCWA
          AR    WK3,WK2 .           FIND 'EXPECTED' CSW1 ADDRESS,
QADR00    DS    0H
          ST    WK3,QMSTRAGE .      STORE EXPECTED CSW1 ADDRESS.
          LA    WK0,QMSTRAGE .      AND CONVERT IT TO EBCDIC.
          BAL   LINK,QCNVRT
          MVC   QMXC1X(6),QWKTEMP+2 STORE IT IN OUTPUT MESSAGE.
          CLC   QMSTRAGE+1(3),5(WK5)
          BE    QMC1ADOK .          IF RCVD ADDR = XPTD ADDR, BRANCH
          OI    QFLGA1,QQAD1
QMC1ADOK  DS    0H
          LA    LINK1,1(LINK1)
QMC1ADNO  DS    0H
          IC    WK1,QMFLGB

          LR    WK0,WK1
          SRL   WK0,6
          BAL   WK2,QMSUPL1B .      GO GET AND SAVE ANY CSW1 STATUS
          MVC   QEXP1STA,QMSUPSAV . MASK PRESENT.

          LR    WK0,WK1
          SRL   WK0,4
          BAL   WK2,QMSUPL1B .      GO GET AND SAVE ANY CSW1 COUNT
          MVC   QEXP1CNT,QMSUPSVR . MASK PRESENT.

          LR    WK0,WK1
          SRL   WK0,2
          BAL   WK2,QMSUPL1B .      GO GET AND SAVE ANY CSW2 STATUS
          LH    WK0,QMSUPSAV .      MASK PRESENT.
          STH   WK0,QEXP2STA
          TM    QMFLGB,QMFM+QMFN
          BC    12,QMNO2DEF .       BRANCH IF NO DEFAULT MASK (00,01,10)
          MVC   QEXP2STA,=XL2'0400' STORE CSW2 STATUS DEFAULT MASK.
QMNO2DEF  DS    0H


          TM    QMFLGB,QMFI+QMFJ
          BC    12,QMDEF1ST .       BRANCH IF NO DEFAULT MASK (00,01,10)
          MVC   QEXP1STA,=XL2'0400' STORE DEFAULT MASK.
          TM    QMFLGA,QMFF
          BO    QMDEF1ST .             0400 IF CC=1 XPTD.
          MVI   QEXP1STA,X'0C'
          TM    QMFLGA,QMFG
          BO    QMDEF1ST .             0C00 IF XPTD CC NE 1,XPTD INTCT=1
          MVI   QEXP1STA,X'08' .       0800 IF XPTD CC NE 1,XPTD INTCT=2
QMDEF1ST  DS    0H
          MVC   QEXP12ST,QEXP1STA

          LA    WK4,QEXP1STA .      GET ADDR OF XPTD CSW1 STATUS.

          MVI   QMCUEBIT,X'00' .    ZERO CUE MASK.
          TM    QDRIVER,X'80'
          BO    QMIDIOSY .          IF RUNNING UNDER A NON-QUIESCED
          TM    QDRIVER,X'FF' .     DRIVER,
          BNZ   QMNORMAL .          OR IF THERE IS NO DRIVER TO PRESENT
QMIDIOSY  DS    0H .                SET-UP CHECK TO ALLOW FOR MULTI-
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          MVI    QMCUEBIT,X'20' .    PROGRAMMING IDIOSYNCRASIES.
          TM     8(WK5),X'20' .
          BZ     QMNOCUE1 .          IF CUE IN CSW1 STATUS,
          OI     QEXP1STA,X'20' SET CUE IN CSW1 EXPECTED STATUS.
QMNOCUE1  DS     0H
          TM     QMFLGA,QMFF .       IF ONLY ONE INTERRUPT WAS EXPECTED
          BZ     QMNORMAL .          BRANCH.
          TM     8(WK5),X'04' .      IF CSW1 STATUS DOES NOT HAVE A DE
          BZ     QMNORMAL .          BRANCH.
          LA     WK4,QEXP12ST .      GET ADDR OF XPTD CSW1+CSW2 STATUS
QMNORMAL  DS     0H
          OC     QEXP12ST,QEXP2STA . CREATE CSW1/CSW2 STATUS MASK.

          IC     WK0,QMFLGB
          SRL    WK0,6 .             GET FLAGS,
          LA     WK1,QMXC1X+7 .      STATUS MESSAGE ADDRESS, AND
          LA     WK3,8(WK5) .        TECB STATUS ADDRESS.
          BAL    WK2,QMSTENT .       GO CHECK CSW1 STATUS.
          BE     QMS1OK .            BRANCH IF CSW1 STATUS IS OK.
          OI     QFLGA1,QQST1
QMS1OK    DS     0H


          XC     QMSTRAGE(2),QMSTRAGE
          TM     QMFLGB,QMFK+QMFL .  IF CSW1 COUNT NOT TO BE CHECKED,
          BZ     QMCTOK .            BRANCH.
          BO     QMCTDEF .           BRANCH IF TO CHECK DEFAULT COUNT
          MVC    QMSTRAGE(2),QEXP1CNT STORE CSW1 COUNT MASK.
QMCTDEF   DS     0H
          LA     WK0,QMSTRAGE .      CONVERT XPTD CSW1 COUNT TO EBCDIC
          BAL    LINK,QCNVRT
          MVC    QMXC1X+12(4),QWKTEMP AND PUT IT IN OUTPUT MESSAGE.
          CLC    QMSTRAGE(2),10(WK5) IF XPTD COUNT = RCVD COUNT,
          BE     QMCTOK .            BRANCH.
          OI     QFLGA1,QQCT1
QMCTOK    DS     0H
          TM     QFLGA1,QQAD1+QQST1+QQCT1
          BZ     QMNOC1ER .          IF ANY CSW1 ERROR DETECTED,
          OI     QFLGA,QQERR+QQS1ER .SET CSW1-ERR, PRINT-ERR FLAGS.

          BAL    LINK,QMSERM .       GO SET-UP FOR XPTD CSW1 MESSAGE.
          DC     AL2(QMXC1-SECTID)
          MVI    QMRC1,C'*' .        FLAG CSW1 RCVD AS AN ERROR LINE.
QMNOC1ER  DS     0H


          BAL    LINK,QMSERM
          DC     AL2(QMRC1-SECTID) . SET-UP RCVD CSW1 MESSAGE

          DS     0H
          BAL    WK3,QZTFNEXT .      GO STEP TO NEXT TECB EVENT FIELD
*                                    AND CONVERT IT TO EBCDIC.
          BNE    QMCKFRSN .          GO, IF NO MORE CSW'S RECEIVED.

          OC     QMACUM+1(7),5(WK5) .ACCUMULATE CSW2 ADDR,STAT,COUNT.
          LA     WK2,QWKTEMP+8 .
          LA     WK3,QMRC2R .        GO SET-UP RCVD CSW2 MESSAGE.
          BAL    LINK,QMSTRCSW
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         CLC   5(3,WK5),=AL4(0)
         BE    QMC2ADOK .          CHFCK CSW2 ADDR FOR ALL ZFROES.
         OI    QFLGA,QQERR+QQS2ER
QMC2ADOK DS    OH
         CLC   10(2,WK5),=AL4(0)
         BE    QMC2CTOK .          CHECK CSW2 COUNT FOR ALL ZEROES.
         OI    QFLGA,QQERR+QQS2ER
QMC2CTOK DS    OH

         TM    8(WK5),X'20' .
         BZ    QMNOCUE2 .          IF CUE IN CSW2 STATUS, AND IF UNDER
         OC    QEXP2STA(1),QMCUEBIT A NON-QUIESCED DRIVER, OR CUE INTO
QMNOCUE2 DS    OH .                CSW2 EXPECTED STATUS.
         LA    WK4,QEXP2STA .      GET ADDR OF XPTD CSW2 STATUS.
         IC    WK0,QMFLGB
         SRL   WK0,2 .             GET FLAGS,
         LA    WK1,QMXC2X .        STATUS MESSAGE ADDRESS, AND
         LA    WK3,8(WK5) .        TECB STATUS ADDRESS.
         BAL   WK2,QMSTENT . GO CHECK CSW2 STATUS.
         BE    QMS2OK .            BRANCH IF CSW2 STATUS OK.
         OI    QFLGA,QQERR+QQS2ER

         TM    QFLGA,QQS2ER
         BZ    QMNOC2ER .          IF ANY CSW2 ERROR,
         BAL   LINK,QMSERM
         DC    AL2(QMXC2-SFCTID) . SET-UP XPTD CSW2 MFSSAGE
         MVI   QMRC2,C'*' .        FLAG CSW2 RCVD AS AN ERROR LINF.
QMS2OK   DS    OH
QMNOC2ER DS    OH


         BAL   LINK,QMSERM
         DC    AL2(QMRC2-SECTID) . SET-UP RCVD CSW2 MESSAGE


QMCKFRSN DS    OH
         MVC   QPRNCCWS(1),QXIOCCWC MOVE CCW CT FROM EXIO TO DRPINT
         L     WK3,QXIOCCWA
         ST    WK3,QADCCW .        MOVE CCW CHAIN ADDR FROM EXIO MACRO
         OI    QPRCTL2,QQCCW .     TO DPRINT MACRO,AND SET PRINT FLAG.

         TM    QFLGA,QQS1ER .      IF AN FRROR WAS NOT FOUND IN CSW1
         BZ    QMSNOUC .           BRANCH.
         L     WK2,QMACUM .        SUBTRACT ADDR OF START OF CHAIN
         SR    WK2,WK3 .           FROM ADDR IN CSW.

         BNP   QMSNOUC .           BRANCH IF CSWS HAD NO ADDRFSS.
         SRL   WK2,3 .             CALCULATE # OF FAILING CCW.
         SR    WK3,WK3
         IC    WK3,QPRNCCWS
         SR    WK3,WK2
         BM    QMSNOUC .           IF # OF FAILING CCW IS LT OR EQ TO
         STC   WK2,QPRFCCWS .      # OF CCWS,STORE # OF FAILING CCW
         OI    QPRCTL1,QQERCCW .   SET UP TO FLAG FAILING CCW.
QMSNOUC  DS    OH
         TM    QMFLGC,QMT .        IF A TIME-OUT IS EXPECTED,
         BO    QNOTMEOU .          BRANCH.
         CLI   QWAITCDE,X'08' .
         BNE   QNOTMEOU .          IF WAIT MACRO TIMED OUT,
         BAL   LINK,QMSERM .           GO SET UP TIME OUT ERROR MESSAGE
         DC    AL2(QMTIOUT-SECTID)     AND SKIP SENSE DATA CHECK AND
         B     QMNOSNSD .              PRINTOUT.
QNOTMEOU DS    0H
         LA    WK1,QMEXTO .            CHECK 'EXIO' AND 'WAITIO' MACRO
         LA    WK2,QEXIOCDE .          RETURN CODES.
         BAL   LINK,QCKCODE
         CLI   QWAITCDE,X'08' .        IF 'TIMED OUT' WAITIO CODE,
         BE    QMTMDOUT .              BRANCH.
         LA    WK1,QMWATO
         LA    WK2,QWAITCDE
         BAL   LINK,QCKCODE
QMTMDOUT DS    0H

         CLI   QMRCCR,X'F2' .          IF RCVD CONDITION CODE WAS 0 OR 1
         BL    QMCHKSNS .              GO CHECK SENSE DATA AS REQUESTED
         OI    QFLGA1,QQCC23
QMNOSNSD DS    0H
         TM    QMFLGB,X'03' .          NO SENSE DATA IS AVAILABLE.
         BZ    QMNOSNSR
         LA    LINK1,2(LINK1)
         BO    QMSTPLSN .              STEP LINK REG AROUND THE SENSE-MASK
         BCTR  LINK1,0 .               NUMBER BYTES PRESENT.
QMSTPLSN DS    0H
         B     QMNOSNSR

QMCHKSNS DS    0H
         CLI   QMRCCR,X'F1'
         BNE   QMCHKSN2 .              IF CONDITION CODE 1 RECEIVED,
         TM    QFLGA,QQCCER .          AND
         BZ    QMCHKSN2 .              IF CC 1 NOT EXPECTED,
         TM    QMSTATUS,X'02' .        AND IF UNIT CHECK NOT RECEIVED,
         BZ    QMNOSNSD .              GO. NO SENSE DATA AVAILABLE.
QMCHKSN2 DS    0H
         LH    WK2,QUCSNS .            GET UNIT-CHECK SENSE-LENGTH.
         TM    QMSTATUS,X'02'
         BO    QTMPUCS .               GO SENSE IF OS-OLTEP.       ***TEMP
         BO    QMUCOCCR .              IF NO UNIT-CHECK OCCURRED,
         LH    WK2,QCHSNS .            GET CHAIN'S SENSE-LENGTH.
QTMPRETN DS    0H .                                                ***TEMP
QMUCOCCR DS    0H
         STH   WK2,QSNSLN .            SAVE SENSE-LTH FOR MESSAGE OUTPUT

         LTR   WK2,WK2 .               IF SENSE-LENGTH IS ZERO,
         BZ    QMNOSNSD .              BRANCH.
         OI    QPRCTL2,QQRSNS .        FLAG'PRINT RCVD SENSE'.

         XC    QSNSMSK,QSNSMSK .
         TM    QMFLGB,QMFP .           IF NO 'ON BIT' SENSE MASK NUMBER
         BZ    QMNONM .                PROVIDED, BRANCH.
         IC    WK2,0(LINK1) .          GET 'ON' MASK NUMBER.
         LA    WK3,QSNP1 .             GET ADDRESS OF ON MASK NUMBER 1.
         BAL   LINK,QMFNDMSK .         GO.CREATE 'ON' BIT ERROR MASK.
         LA    LINK1,1(LINK1)

QMNONM   DS    0H
         LA    WK3,QSFP0 .             GET ADDRESS OF DEFAULT OFF MASK.
         LA    WK2,1
         TM    QMFLGA,QMFB .           IF DEFAULT 'OFF' MASK SPECIFIED,
         BO     QMOFDEF .              BRANCH.
         TM     QMFLGB,QMFO .          IF NO 'OFF' MASK PROVIDED,
         BZ     QMNOOFF .              BRANCH.
         IC     WK2,0(LINK1) .         GET 'OFF' MASK NUMBER.
         LA     WK3,QSFP1 .            GET ADDRESS OF OFF MASK 1.
         LA     LINK1,1(LINK1)
QMOFDEF  DS     0H .                   GO CREATE 'OFF' BIT ERROR MASK
         BAL    RLINK,QMFFOMSK

QMNOOFF  DS     0H
QMNOSNSR DS     0H
         TM     QPRCTL2,QQRSNS .       CK IF TO PRINT SNS DATA
         BZ     QSNMGEX .              BR IF NOT

         XC     QSNMSG1(QSNMSGAL),QSNMSG1 CLEAR SNS MSG ADDRESSES
         MVI    QSNMPOR,0 .            CLEAR SNS MSG ADRS SAVE POINTER
         LA     WK0,QTECSD01 .         CONVERT SNS DATA TO EBCDIC
         BAL    LINK,QCNVRT
         LA     WK3,QRVSNM1 .          MOVE SNS DATA TO OUTPUT AREA
         BAL    LINK,QSNMOVE

         TM     QPRCTL1,QQERSNS .      CK SNS ERROR FLAG
         BZ     QSNMGP .               BR IF NO ERROR

         MVI    QRVSNM1,C'*' .         SET ERROR FLAG ON SNS DATA LINES
         MVI    QRVSNM2,C'*' .
         MVI    QSNMPOR,4 .            SET SNS MSG ADRS SAVE POINTER
         LA     WK0,QSNSMSK .          CONVERT SNS MASK TO EBCDIC
         BAL    LINK,QCNVRT
         LA     WK3,QMKSNM1 .          MOVE SNS MASK TO OUTPUT AREA
         BAL    LINK,QSNMOVE

QSNMGP   DS     0H
         LA     WK5,QSNMSG1 .          ADRS OF FIRST SNS MSG ADDRESS
         LA     WK0,4 .                NUMBER OF MESSAGES TOTAL
QSNMGP2  L      WK1,0(WK5) .           FETCH ADRS OF MSG
         LTR    WK1,WK1 .              CK IF VALID ADRS
         BZ     QSNMGP4 .              PLACE IN MG AREA IF YES
         BAL    LINK,QMSERM2

QSNMGP4  LA     WK5,4(WK5) .           POINT TO NEXT MESSAGE
         BCT    WK0,QSNMGP2 .          CONTINUE WHEN ALL MSGS CHECKED
****************************** EXIO MACRO *************************
*
*******************************************************************
QEXCEXIO DS     0H
         STM    LINK1,WK1,QSVREGS2 .SAVE REGS FROM OLT(S)EP.
QEXIOMAC LA     R14,R0088 .        RETURN ADDRESS
         CNOP   0,4
         BAL    R1,#EXIT .             BRANCH TO LINKAGE SUBROUTIN
QEXIOLST DC     B'00000000' .          CONTROL PROGRAM FLAGS
         DC     AL1(2) .          MACRO LEVEL
         DC     CL2'35' .              MACRO ID
         DC     A(QTECB) .             TECB ADDRESS
         DC     A(QCDST) .          ADDRESS OF CONFIGURATION DATA
         DC     A(*) .            CCW ADDRESS
         DC     AL1(1) .         CCW COUNT
         DC     AL1(0) .               FLAG BYTE
```

```
*                                         FLAG BYTE DEFINITION
*                                         BIT 0 - ATTNIN
*
R0088    DS     0H
         STC    R15,QEXIOCDE .            STORE RETURN CODE.
         BAL    LINK,QREGRSTR .
         BR     LINK1 .                   RETURN AFTER RESTORING REGS

****************************** WAIT MACRO **************************
*
********************************************************************
QDELAY   DS     0H
         MVC    QWIOTIME(2),0(LINK1) STORE DESIRED DELAY TIME.
         XC     QWIOTECB(4),QWIOTECB ZERO TECB ADDRESS.
         MVI    QWIOFLAG,X'00' .      ZERO WAITIO FLAGS.
         LA     LINK1,2(LINK1)
         B      QWAITOH
QWAIT    DS     0H
         MVC    QWIOTECB(4),=A(QTECB) STORE TECB ADDR. (IT MAY HAVE
*                                       BEEN WIPED VIA A 'DELAY' OPTION.
QWAITOH  DS     0H
         STM    LINK1,WK1,QSVREGS2 .SAVE REGS FROM OLT(S)EP.
         L      LINK1,QWIOCDS SAVE DEV ADR FOR QPRINT
         MVC    QPRDEVAD(2),2(LINK1)
QWAITMAC LA     R14,R0089 RETURN ADDRESS
         CNOP   0,4
         BAL    R1,#EXIT .               BRANCH TO LINKAGE SUBROUTINE
QWAITLST DC     B'00000000' .            CONTROL PROGRAM FLAGS
         DC     AL1(2) .          MACRO LEVEL
         DC     CL2'36' .                MACRO ID
         DC     A(QTECB) .             TECB ADDRESS
         DC     A(QCDST) .          ADDRESS OF CONFIGURATION DATA.
         DC     AL1(128) .          FLAGS
*                                     FLAG FIELD DEFINITION :
*                                      BIT 0 - WAIT=YES.
*                                          1 - POLL.
*
         DC     AL2(99) .               TIME IN SECONDS.
R0089    DS     0H .                    RETURN ON HALFWORD BOUNDARY.
         STC    R15,QWAITCDE .           STORE RETURN CODE.
         BAL    LINK,QREGRSTR .
         BR     LINK1 .                  RETURN AFTER RESTORING REGS
QTMEDFLT DC     AL2(99) .                WAIT=YES DEFAULT TIME.

********************************** CDS TABLE ***********************
*
********************************************************************

QCDSLN   EQU    10+6 .        LENGTH OF EACH CDS ENTRY
QCDSFG   EQU    6 .             DEVICE FLAGS AREA LENGTH IN QCDSLN
QCDSADR  DS     1F .                  ADDRESS OF ACTIVE DRIVE CDS
QCDSEND  DS     1F .                  ADDRESS OF LAST CDS TABLE ENTRY
QCDST    DS     CL(QCDSLN*16) .     CDS ENTRY TABLE

****************************** $TECB MACRO *************************
*
********************************************************************
```

```
QTECB    DS    0F .                TECB STARTS
QTECFDCT DC    AL1(18) .           NUMBER OF EVENT FIELDS
QTECFDLN DC    AL1(12) .           LENGTH OF EVENT FIELDS
QTECSNLN DC    AL2(27) .           LENGTH OF SENSE FIELDS
         DC    AL1(0) .            FLAGS
QTECSNCT DC    AL1(1) .           NUMBER OF SENSE FIELDS
QTECSNOC DC    AL1(0) .            NUMBER OF SENSES HAVING OCCURRED
QTECFVOC DC    AL1(0) .            NUMBER OF EVENTS HAVING OCCURRED
****   EVENT BLOCKS   ****
QTECFD01 DC    XL12'00'
QTECFD02 DC    XL12'00'
QTECFD03 DC    XL12'00'
QTECFD04 DC    XL12'00'
QTECFD05 DC    XL12'00'
QTECFD06 DC    XL12'00'
QTECFD07 DC    XL12'00'
QTECFD08 DC    XL12'00'
QTECFD09 DC    XL12'00'
QTECFD0A DC    XL12'00'
QTECFD0B DC    XL12'00'
QTECFD0C DC    XL12'00'
QTECFD0D DC    XL12'00'
QTECFD0E DC    XL12'00'
QTECFD0F DC    XL12'00'
QTECFD10 DC    XL12'00'
QTECFD11 DC    XL12'00'
QTECFD12 DC    XL12'00' .          LAST EVENT BLOCK
****   SENSE FIELDS   ****
QTECSN01 DC    XL27'00' .          LAST SENSE FIELD
QTECSD01 EQU   QTECSN01+3
QTECBEND EQU   * .                   END OF TECB FIELD
QTECFLTH EQU   12 .           TECB EVENT FIELDS' LENGTHS.
QTECELST EQU   QTECSN01-QTECFLTH . LAST EVENT FIELD'S ADDRESS.
QTECSLTH EQU   27 .             TECB SENSE FIELDS' LENGTH.
QTECSLST EQU   QTECBEND-QTECSLTH LAST SENSE FIELD'S ADDRESS.


************** GENERAL CONSTANT, STORAGE, AND WORK AREAS **********
*
*******************************************************************
QWKTEMP  DS    6D .               DOUBLE WORD WORKING AREA (12F MIN)

QOLTREGS DS    (LINK-WK0+1)F .      SAVE AREA FOR OLT REGS WK0-LINK.
QSVREGS2 EQU   QPRRLST+4 .          FOUR FULL WDS OF SAVE AREA


QREFNO   DC    XL2'00' .            LAST REF # PASSED VIA 'ZPROF'.
QSNSLN   DC    AL2(24) .            RCVD SNS BYTE COUNT
QSNSDLTH DC    AL2(24) .          SENSE COMMAND DEFAULT FIELD LENGTH.


QDISEXIL DC    AL1(QDISREFL) .       THIS REFERENCE LENGTH VARIES.
QDISEXIO DC    C'AE' .            SUB-SYSTEM,SECTION REFERENCE NUMBER
QDISRTN  DC    CL2' ' .              ROUTINE NUMBER.
QDISREF  DC    CL2' ' .               MESSAGE REFERENCE NUMBER.
QDISREFL EQU   *-QDISEXIO .          TOTAL REFERENCE NUMBER LENGTH.
QDISBFRB DC    C' ' .                SPACE TWIXT REF # AND MESSAGE.
QDISEXIB DC    CL255' ' .         CURRENT EXIO DESCRIPTION
QSNSMSK  DC    CL24' ' .          SENSE ERROR BIT MASK.
```

```
*  DEFAULT 'OFF' BIT SENSE MASK.
QSFPO    DC    AL1(0) .                STARTING POSITION IS BYTE 0.
         DC    AL1(L'QSFMO) .          MASK LENGTH.
QSFMO    DC    X'FFA100F9DABE40FFDF41BDFDFD000000000080000001'


QEXIOCDE DC    XL1'00' .               LAST 'EXIO' RETURN CODE.
QWAITCDE DC    XL1'00' .               LAST 'WAIT' RETURN CODE.
QLINE    DC    C'------------------------------'

***************************** STATUS FLAGS ************************
*
********************************************************************

*   ERROR STATUS FLAGS
*        ZEROED BY QIOCK SUBROUTINE.
         DS    0H
QFLGA    DC    AL1(0) .      IF FLAG = 1,
QQERR    EQU   X'80' .             ERROR OCCURRED, PRINT THE ERROR
QQCCER   EQU   X'40' .             CC ERROR
QQISER   EQU   X'20' .             INITIAL STATUS ERROR.
QQS1ER   EQU   X'10' .             CSW1 ERROR.
QQS2ER   EQU   X'08' .             CSW2 ERROR.
QQSNER   EQU   X'04' .             SENSE ERROR.

QFLGA1   DC    AL1(0) .      IF FLAG = 1,
QQCC23   EQU   X'80' .             RCVD CC WAS 2 OR 3.
QQAD1    EQU   X'40' .             CSW1 ADDRESS WAS BAD.
QQST1    EQU   X'20' .             CSW1 STATUS WAS BAD.
QQCT1    EQU   X'10' .             CSW1 COUNT WAS BAD.


*   NON-ERROR STATUS FLAGS
QFLGB    DC    AL1(0) .      IF FLAG = 1,
QQPRT    EQU   X'80' .             PRINT THE MESSAGE
QQLIB    EQU   X'40' .             CURRENT OPERATION IS ON A LIBRARY



QQXCK    EQU   X'20' .             ZEXCK INITIATION.
QQXPE    EQU   X'10' .             ZEXPE INITIATION.
QQLPERR  EQU   X'08' .             LOOPING ON ERROR FLAG
QQCLNUP  EQU   X'04' .             IN CLEANUP SUBROUTINE FLAG
QQFRUAD  EQU   X'02' .             FRU CODE IN ERROR MSG
QFLGL    EQU   *-QFLGA . ********* LENGTH OF FLAGS AREA ***********
*                                  ZEROED BY DEVICE SCHEDULER


*  DEVICE STATUS FLAGS. (SETUP VIA ZSREW MACRO.)
*        NEVER ZEROED. STORED BY ZSREW MACRO SUBROUTINE.
QFLGD    DC    AL1(0) IF FLAG = 1,
QQDNR    EQU   X'80' INTERVENTION REQ'D (DEV NOT READY).
QQDFP    EQU   X'40' DEVICE IS FILE PROTECTED.
QQN7T    EQU   X'20' DEVICE IS NOT A 7-TRACK DRIVE.
QQN9T    EQU   X'10' DEVICE IS NOT A 9-TRK-NRZI DRIVE.
QQNPE    EQU   X'08' DEVICE IS NOT 9-TRACK-PE DRIVE.
QQN79    EQU   X'04' DEVICE IS NOT 7 & NOT 9 TRK NRZI.
QSNFRF   EQU   QQN7T+QQN9T+QQNPE+QQN79 REQUIRED FEATURES FLAGS.
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```
*  EQUATED LABELS FOR ZSREW USE.
QNRDY     EQU   X'80'
QFP       EQU   X'40'
QN7TRK    EQU   X'20'
QN9TRK    EQU   X'10'
QNPE      EQU   X'08'
QNNRZI    EQU   X'04'

QERRNO    DS    H .                 LOOP ON ERROR REFNUM FROM ZPROE


****************************** CONVERT MAP *************************
CONVMAP   DSECT
          DC    XL1'0' .            CONTROL PROGRAM FLAGS
          DC    XL1'0' .            MACRO LEVEL
          DC    XL2'0' .            MACRO ID
$CNVFROM  DC    A(0) .              FROM ADDRESS
$CNVTO    DC    A(0) .              TO   ADDRESS
$CNVCT    DC    XL2'0' .            TYPE & COUNT

          DC    XL1'0' .            CONTROL PROGRAM FLAGS
          DC    XL1'0' .            MACRO LEVEL
          DC    XL2'0' .            MACRO ID
$XIOTCBA  DC    A(0) .              TECB ADDRESS
$XIOCDSA  DC    A(0) .              CDS  ADDRESS
$XIOCCWA  DC    A(0) .              CCW  ADDRESS
$XIOCCWC  DC    XL1'0' .              OF CCW'S
$XIOFLAG  DC    XL1'0' .            FLAG BYTE
QXIOTCBA  EQU   QEXIOLST-EXIOMAP+$XIOTCBA
QXIOCDSA  EQU   QEXIOLST-EXIOMAP+$XIOCDSA
QXIOCCWA  EQU   QEXIOLST-EXIOMAP+$XIOCCWA
QXIOCCWC  EQU   QEXIOLST-EXIOMAP+$XIOCCWC
QXIOFLAG  EQU   QEXIOLST-EXIOMAP+$XIOFLAG

******************************** WAIT MAP ***************************
WTIOMAP   DSECT
          DC    XL1'0' .            CONTROL PROGRAM FLAGS
          DC    XL1'0' .            MACRO LEVEL
          DC    XL2'0' .            MACRO ID
$WIOTECB  DC    A(0) .              ADDRESS OF TECB
$WIOCDS   DC    A(0) .              ADDRESS OF CDS INFO
$WIOFLAG  DC    XL1'0' .           FLAGS
$WIOTIME  DC    XL2'0' .            TIME IN SECONDS
QWIOTECB  EQU   QWAITLST-WTIOMAP+$WIOTECB
QWIOCDS   EQU   QWAITLST-WTIOMAP+$WIOCDS
QWIOFLAG  EQU   QWAITLST-WTIOMAP+$WIOFLAG
QWIOTIME  EQU   QWAITLST-WTIOMAP+$WIOTIME


*********************************** ROUTINE MAP ********************
RTNEMAP   DSECT
          DC    XL1'0' .            CONTROL PROGRAM FLAGS
          DC    XL1'0' .            MACRO LEVEL
          DC    XL2'0' .            MACRO ID
$RTNEEXT  DC    A(0) .              ADDRESS OF NEXT ROUTINE
$RTNENUM  DC    XL1'0' .            THIS ROUTINE NUMBER
$RTNEREF  DC    XL1'0' .            REFERENCE NUMBER
$RTNEFLG  DC    XL1'0' .            FLAGS
QRTN#     EQU   QRTNCTL+$RTNENUM-RTNEMAP ROUTINE NUMBER
QRTNREF   EQU   QRTNCTL+$RTNEREF-RTNEMAP ROUTINE REFERENCE NUMBER
```

```
QRTNFLG   EQU   QRTNCTL+$RTNEFLG-RTNEMAP.FLAGS
QRTNMI    EQU   X'80' .              MANUAL INTERVENTION FLAG
QRTNADR   EQU   QRTNCTL+$RTNEEXT-RTNEMAP ROUTINE ADDRESS



******************** CONDITIONAL BRANCH EQUATES ******************

*  AFTER COMPARE INSTRUCTIONS.
BH        EQU   2 .                  BRANCH ON A HIGH.
BL        EQU   4 .                  BRANCH ON A LOW.
BE        EQU   8 .                  BRANCH ON A EQUAL B.
BNH       EQU   13 .                 BRANCH ON A NOT HIGH.
BNL       EQU   11 .                 BRANCH ON A NOT LOW.
```

The other flowcharted tests can be similarly implemented in the samq manner as set forth above. Such source code is not included because it would be cumulative, rather than instructive.--

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In interfacing circuits for generating an anomalous indication from a subsystem in response to a requesting signal from a controlling data processing system interconnected with said subsystem via said interfacing circuits, means chaining said subsystem to a CPU, means supplying a flag signal,

means selectively setting a diagnostic mode,

memory means for maintaining a status indication and a flag signal, means gating said status indication,

logic means responsive to said requesting signal and another signal to generate a gating signal,

the improvement including in combination:

AND circuit means jointly responsive to said requesting signal and a flag signal from said subsystem to supply an enabling signal,

said subsystem capable of setting said flag signal only when chained to a CPU and in a diagnostic mode of operation,

encoding means responsive to said status indication or to said enabling signal to generate a code permutation representing said status indication, and

said gating means being responsive to said enabling signal or to said gating signal to gate said code permutation to said CPU.

* * * * *